Street Lighting on a Cost-of-Service Basis—*Service Requirements for Electric Arc Furnaces with other articles and the regular departments.*

Electrical World

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Engineering

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Electrical World

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What the Utility Returns to the Public

THAT the local utility is a part of the community and carries its proportional share of the going costs of the community is sometimes overlooked by the public. It ought to be made clearer. The public forgets that the utility, the same as any other business enterprise in the town or city, not only pays taxes and carries a payroll but also takes part in the business activity of the town. The utility is run for profit, like any other business in the community, but the fact is often overlooked that in rendering service to the individual in exchange for money the utility carries on an enterprise which helps make for growth and development of the town as a whole. Some central stations, for example, have advertised the advantages of the community in which they are located for industrial purposes. New industries brought to a town in this way will undoubtedly benefit the central station. It is equally evident that they will help business as a whole in the community. Detailed facts showing just what the utility returns to its community carry weight. The presentation of such facts by company officials before the local chamber of commerce will appeal to the public's sense of justice.

Problems in Manufacturing Design

DEMAND on the world sources of raw materials has brought about a shortage in supply which is leading to curious anomalies in market conditions. A few months ago manufacturers were waiting for orders—now the output for manufactured products in many lines to meet the tremendous demand is limited by the materials which can be purchased. Salesmen for steel companies, we are told, spend their time not in trying to get orders but in visiting their customers and keeping in touch with their wants so as to adjust and apportion shipments fairly. Second-hand materials and supplies are being used instead of being scrapped. There is a special opportunity for the designing engineer in this unusual situation. He may devise ways and means to use less material by changes in design, or evolve new designs in which one material may be substituted for another. In one case pressed-steel stampings were substituted for aluminum castings. By means of ingenious dies the designer made it possible to press out the shell-like stampings, which were afterward electrically welded to form the complete part. This change was forced, not because of any disadvantage of aluminum but because of the relatively higher cost of that metal at the present time.

Taking an Industrial Census

ENGINEERS have a peculiar interest in the statistics on industrial preparedness which a special committee of the Naval Consulting Board has undertaken to collect. It will be remembered that the general plan comprises the taking of an industrial inventory of our factories for use in case of war. Each state, including Alaska, has a board of five men—one from each of the five great technical societies, the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers, the American Chemical Society and the American Institute of Electrical Engineers. Information from the forty-nine working boards so constituted will clear through W. S. Gifford, chief statistician of the American Telephone & Telegraph Company. Forms will be prepared based upon what business men consider it necessary to know in arriving at the physical capacity of the plants and their fitness and reliability for specific classes of output. The form in the first instance will go to some 30,000 concerns, and it calls for every bit of information necessary to the Government in time of war. The form will go to the manufacturer through the state directors, who will pass it on to the best qualified engineer in the field, who will be known as a field aide, and will be held personally responsible for the filling out of the form. This form has been passed upon by the army and navy authorities, and the inventory will probably be made during the month of May. By collecting and assembling these statistics in such a way as to make possible the apportionment of orders, it is hoped to develop our industrial resources for war nationally, in a geographic sense. It will bring to the support of the army and navy, industrial centers west of the Alleghanies and away from the exposed seaboards. With the data it is hoped that employment may be given in a uniform manner to a maximum number of men. It is a compliment to the electrical industry that the engineering thoroughness with which statistics are made the basis for progress in the branch of telephone engineering, has been recognized. The practical success of this national plan depends in no small measure upon the intelligent direction of the mechanism for collecting the statistics and the plan for putting them into useful form. Telephone engineers have put codified engineering data to every-day use more extensively than any other branch of the electrical industry. Moreover, the making of an electrical census for a specific purpose should help considerably to clarify our needs in regard to all such statistical summaries which are national in scope.

Contracts for Street Lighting

THE problem of providing suitable rates and contracts for street lighting is becoming increasingly difficult. At best it is complicated, and becomes still more so when one considers the rapid changes there have been in the art and the increasing requirements for underground and other special service. We present on a following page an abstract of a paper on this subject by G. W. Van Derzee, which seems to offer at least one practical solution of the difficulty—a solution which may prove of considerable value in dealing with the troublesome existing conditions. The proposition is, in brief, to furnish street lighting on a reasonable "cost-of-service" basis, the municipality assuming full responsibility for the integrity of the operating company's investment in special apparatus and equipment for street lighting purposes. Such a form of contract is recognized under the Wisconsin statutes, so that it may be regarded as a practical possibility. Under this arrangement the contract would generally be of indefinite length, the municipality merely undertaking when the "cost-of-service" contract is terminated, to pay to the operating company the difference between the cost of its special investment in street-lighting equipment and the recovery value, whatever it might be. The fixed charges on this equipment, with considerable allowance for depreciation, would form part of the "cost-of-service" price. These fixed charges are to a considerable extent within the control of the municipality, for if the density of service is increased the average fixed charges will go down, while if long extensions are made or underground service is undertaken, they will go up by an amount depending on the suitable charges on the cost. As things are now, the public-service corporation must take its chances on the renewal of contracts for a definite term, and so must make provision in the price for the amortization, in some form, of its special investment. On a continuing "cost-of-service" contract this allowance drops out of sight, for it is entirely the municipality's business whether it keeps on with its lighting at cost of service or chooses to do something else, in which latter case it assumes the responsibility for the remaining value of the special investment.

The advantage to the municipality lies in obtaining its lighting at a cost, in the case worked out by Mr. Van Derzee perhaps 20 per cent or so below what could properly be charged on a five-year contract. The utility is perfectly secure in its investment, and all proper charges against it, in suitable payment for all services rendered whether in labor or in furnishing energy, and in the proper fixed charges of every kind which should be apportioned to the street lighting work. The municipality obtains a very low figure for its lighting compared with what would have to be charged on a short-term contract, and is able to take advantage at will of changes in the art which may seem to its advantage. The system seems easier to operate than to initiate, since the suitable valuation of old equipment, particularly when there is joint use for street- lighting and other service, to ascertain the present value at which it should enter into the agreement, is a somewhat serious matter. Some equitable arrangement would have to be made between the city and the utility for a proper sharing of advantages accruing from improvements, and proper adjustment of the fixed charges on the special investment due to incidence of depreciation and changes in the system.

The plan seems a somewhat radical one in which the utility must be satisfied with a very modest return on its investment, although this return is a certain one and there are no serious contingencies arising from the possible sudden termination of a contract. It has the advantages of a very long term contract without tying up the municipality to a definite period of years. Practically we should think that the result, if the scheme were properly worked out, would be the assurance of the business to the utility for an indefinite term of years, subject to an annual revision in price exactly commensurate with the rise or fall of cost of service. This revision would automatically check foolish requirements for changes without blocking those which would actually result in a better and cheaper service.

The dubious factor in the case seems to be doubt as to whether the utility could secure what it would properly regard as a suitable return for its investment and services. Nevertheless, we would much like to see Mr. Van Derzee's plan tried out in a favorable situation as a test of its practical working qualities.

The Electric Furnace as a Station Load

IN a brief paper, which we publish this week, Mr. Hollis gives a most instructive report on the operation of an electric steel furnace from the general supply of a central station. Off-hand, one would almost be inclined to say that the load was of a kind quite unsuited for central-station operation, and so indeed it would be unless care were taken to minimize so far as possible the necessarily great variations in the load. The system of the Lebanon (Pa.) station, where a 1-ton Heroult furnace is now operated, is fed by two turbo-generators, one of 1250-kw. and the other of 500-kw. rating. The furnace, which is supplied by 2400-volt feeders and transformers stepping the pressure down to 110 volts, is rated at 225 kva., at a nominal power factor of 92 per cent. In point of fact the characteristics of the load are such that the power factor may often drop very low from short-circuit or overload conditions, and the demand for power may be suddenly increased many fold.

The furnace is substantially a big three-phase electric arc without any steadying resistance or reactance, and is liable to be short-circuited at any moment during certain stages of the melting. A complete heat covers three hours and a half, and after the

first half or three-quarters of an hour short-circuits are likely to occur at any time until the charge is fully melted near the end of the run. Such conditions are entirely characteristic of the operation of a furnace melting cold scrap steel, and the ability of the station to handle such a load depends on its capacity and the judgment used in arranging the supply. The normal variation in the furnace load, barring the short-circuits, is something like 30 per cent above and below the rating. To handle a load of this kind from a station of the rating noted is no easy task, for the load on short-circuit, on the original characteristics of the line as respects resistance and reactance, might rise to about fourteen times the full-load current of the furnace, thus calling, in spite of the low power factor, for more than 1500 kw. The short-circuit situation is met by a closely set automatic cut-out, which throws out the furnace feeder at about double load. In addition it was found desirable to add artificial reactance, doubling the reactive drop in the system. Under these circumstances the short-circuit current was limited to about eight times full load, and by close setting of the time-limit relay it became possible to drop the load without creating a quite impossible disturbance. Load can be picked up again easily enough, by feeding a little coke into the furnace, through which the first arc can be struck. Obviously such a short-circuit in the steel furnace must produce perceptible effects on the system, but by the devices mentioned a short-circuit load is thrown off so quickly that no serious disturbance is produced. And the best evidence of this is that another furnace of double the capacity is to be taken on to the same system. The transformers for this additional furnace are deliberately made with a reactance drop of 10 per cent to help out under the difficult short-circuit conditions.

Investigation of Magnetic Laws for Steel and Other Materials

CONSIDERING how many centuries have elapsed since magnetic phenomena first became recognized on this planet, it is remarkable how little has yet been learned concerning the nature and laws of magnetism. All that we are able to affirm, with a reasonable degree of certainty, is that whatever electricity and magnetism may be, they must be so interrelated that one is the consequence of the curl of the other, which is one aspect of Maxwell's electromagnetic theory. As an instance of our magnificent international ignorance of the nature of terrestial magnetism, the simple historical fact may be cited that in 1582, the date of the international introduction of the Gregorian Calendar, with a sudden jump of ten days, the magnetic needle at London pointed 11 deg. easterly of the geographic meridian, whereas it now points nearly 16 deg. westerly of that meridian, and in 1820 nearly attained 25 deg. of westerly declination, a total swing of more than 36 deg., while no satisfactory theory of this large change has yet been produced.

A very interesting paper, referred to at some length in this week's *Digest*, was presented, in December last, in Philadelphia, by John D. Ball, and is being printed in the *Journal of the Franklin Institute*. This paper gives the results of experimental researches in the magnetic behavior of magnetic metals, and particularly of silicon steel. As the paper points out, there are two laws of magnetism in magnetic metals which have been known for more than twenty years, namely, the Kennelly straight-line of reluctivity versus magnetic force, and the Steinmetz 1.6th power law of hysteretic power versus maximum cyclic flux-density. Neither of these laws rests on any basis of theory. They merely represent more or less definitely indicated results of experiment. Flaws, or deviations, have presented themselves in each when certain particular samples of magnetic material, such as sheet steel, have been investigated. The paper shows that these deviations may be, and should be, ascribed to the effects of scale, or the superficial oxide layers, on the ordinary sheet steel of commerce. This scale may be regarded as having a depth of perhaps 10 per cent of the sheet thickness at both upper and lower surfaces. The resistivity and reluctivity of the scale are naturally much greater than that of the steel; so that, unless the observations made on steel plus scales are corrected for the effects of the scales, the results must be expected to be conglomerate and imperfect, representing the magnetic behavior of neither steel nor scale.

By carefully collecting silicon-steel scale, and testing this material separately, some new and valuable experimental data have been secured and presented in the paper. Then, correcting the observations on ordinary scaly sheet steel for the estimated thickness of scale present, the results indicate a remarkable confirmation of both the Kennelly and Steinmetz laws.

The paper is a very valuable contribution to our engineering literature of magnetism as an applied science.

The Coming Issues

NEXT week, in the station-operating number of the ELECTRICAL WORLD for April, a leading article will describe operating methods in a 100,000-kw. central-station boiler plant. A symposium of actual experience with iron-wire transmission lines, to appear in the same issue, becomes especially timely just now, with the increasing price of copper. The lubrication of prime movers and industrial-plant machinery is the subject of another article of particular usefulness to plant-operating men. In the engineering number of April 15 possible simplifications in the design and construction of an outdoor substation are pointed out, as exemplified in an important industrial-service installation. The adaptation of station and line operating methods to minimize accidents will be the subject of a compilation of safety-first practices also to appear in that issue. Following the usual program the fourth issue of the month will be devoted largely to commercial and electrical sales topics.

Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

Exhibit Plans for N. E. L. A. Convention

The exhibition committee of the National Electric Light Association, which has been negotiating for weeks to secure the Auditorium Theater in Chicago for the exhibits of the Class D members in connection with the convention of the association to be held in Chicago in May, owing to leasing and other conditions has not been able to make any announcement until this time. Negotiations, however, are far enough along now to permit the committee to at least make tentative arrangements for the exhibits in the theater.

Since space as well as time is limited, all those who are intending to make an exhibit are urged to communicate at once with the committee and to signify their space requirements. The exhibit, it is stated by the committee, will be somewhat along the lines of the Philadelphia exhibit provided the present plans are carried out.

Alabama Power Company Plans Hundred-Million-Dollar Bond Issue to Finance Future Increases

The Alabama Power Company, whose properties include several sites on the Coosa River, one site on the Tallapoosa River, a site on Little River and sites at Muscle Shoals on the Tennessee River, is contemplating an extensive development to extend over a number of years, among which is an immediate increase of 50,000 hp. in generating equipment. Of this equipment 20,000 hp. will be added to the company's new Lock 12 hydroelectric development on the Coosa River, 45 miles southeast of Birmingham, whose present installed capacity is 70,000 hp. It is ultimately planned to increase this station to at least 110,000 hp. The other 30,000 hp. will be taken up in a new steam plant to be located on the banks of the Black Warrior River, in the heart of the coal mining district, and which will be designed so as to admit of very material enlargement.

To finance the probable future requirements of the company an issue of $100,000,000 of first mortgage 5 per cent bonds, due March 1, 1946, has been authorized, of which $4,000,000 was offered by the Underwriters to the investing public this week.

The Alabama Power Company was incorporated in 1906 under the laws of the State of Alabama and serves directly and indirectly the major part of the urban population of northern Alabama, including the so-called Birmingham district and comprising a total population estimated at over 325,000. The company does directly all the electric light and power business in Anniston, Attalla, Talladega, Huntsville, Decatur and New Decatur and several other smaller places; all the street railway business in Anniston and Huntsville and the gas business in Anniston, Decatur and New Decatur. It furnishes under contract all the energy used by the Birmingham Railway, Light & Power Company in greater Birmingham and Bessemer and all the energy used by the local public service companies in Gadsden, Tuscaloosa and Alexander City. In addition. it serves under contract many large industrial power consumers.

The Coosa River plant, or as it is more commonly known, the Lock 12 plant, which is now being increased to 90,000 hp., is one of the largest in the South and has only recently been completed. At this plant a head of 68 ft. is available and 60-cycle, three-phase energy is generated at 6600 volts.

This development, situated midway between Birmingham and Montgomery, the two largest important cities in the State, contains at the present time four 17,500-hp. vertical single-runner turbines, which at the time of installation were the largest single-runner units ever built for 70-ft. head.

The company's gross earnings for 1915 amounted to $1,041,148 as compared with $619,809 for the twelve months of 1914. This represents an increase of $431,339 or 68 per cent. The net earnings of 1915 were $638,606 as compared with $307,463 for 1914. This is a gain of $331,143 or 108 per cent.

Minnesota Electrical Association

Minneapolis Convention Topics Included Electric Cooking, Concentric Wiring, Rates, Boiler Efficiency and Rural Line Extensions

The ninth annual convention of the Minnesota Electrical Association was held at the Hotel Radisson, Minneapolis, on March 21 and 22. During the opening session reports of various committees were read, and President T. D. Crocker presented his address. At the Tuesday afternoon session Mayor Nye of Minneapolis addressed the delegates, welcoming them to the city, after which A. J. Cross of the General Electric Company presented a paper on "The Possibilities and Practicability of the Electric Range." This paper dealt at length with the advantages of cooking with electricity, particularly where the cost of fuel is high, and where gas is not available. The paper provoked a lively discussion between the combination gas-electric plant and the electric-plant members of the association.

Elements of Rate Making

W. C. Beckford, in a paper on the subject of "Electricity Rates," showed in detail the elements entering into electric-service rate making, and emphasized the fact that any electric-service rate involves three different elements, namely, the plant-equipment overhead charge, the output charge, and the consumer charge. The sum of the overhead and the consumer charge makes up the amount which should be charged as the minimum bill. To this amount should be added the product of the number of kilowatt-hours used, multiplied by the output cost of the energy, plus the net to be earned. The author also showed in detail how certain rates vary with the number of hours of use, and gave an example of developing a "step" rate.

On Wednesday morning E. J. LaBlond of the Minneapolis General Electric Company presented the report of the committee on "rural-line extension." He took up in detail the possibilities of making extensions into rural districts, and the returns received from such services, the cost of making the extensions and methods of installation.

At the same session H. E. Eisenmenger of the Na-

tional Lamp Works, Cleveland, Ohio, presented a very interesting paper on "Concentric Wiring," and European methods of handling small customers. Mr. Eisenmenger showed samples of fittings used in concentric-wiring work, and illustrated his talk with numerous lantern slides. His paper provoked a lively discussion, particularly from the electrical inspectors present at the meeting, who took a stand against the adoption of concentric wiring.

Prof. W. T. Ryan of the University of Minnesota presented a paper on "Central-Station and Transmission Statistics." Professor Ryan went into detail regarding the value of diversity factor and the characteristic demands of various classes of central-station customers.

H. S. Whiton of the Minneapolis General Electric Company presented a paper on "Boiler-room Efficiency." He showed how the various losses are divided—from the coal pile to the prime mover. He advocated the use of indicating and recording instruments in the boiler room, in order to check up and observe the operation of the boilers intelligently.

O. A. Rofelty of the Minneapolis company also presented a paper on "The Attitude of Central Stations Towards the Small Consumer."

The convention closed with the annual banquet, at which J. Adam Bede, former Congressman from Minnesota, was the principal speaker.

The following officers of the association were elected for 1916: President, Ludwig Kemper, Albert Lea, Minn.; secretary and treasurer, R. F. Porter, St. Cloud, Minn.

Government Contractor Not Liable for Use of Patented Inventions

Owners of patents claiming infringement of their rights by contractors to the United States government cannot interfere with execution and delivery by suing contractors, and may obtain relief only from the government itself, according to the decision handed down on March 15 by the Court of Appeals in the Marconi-Simon case.

The Marconi Wireless Telegraph Company of America sought an injunction to prevent Emil J. Simon, a radio engineer of New York City, from producing twenty-five wireless sets for submarines of the United States Navy on a contract awarded him for delivery on Jan. 1, 1916.

The plaintiff claimed infringement of the basic Marconi patent (No. 763,772), while the defendant maintained that any action should be brought against the government itself for demanding the precise arrangement in its specifications. Walter H. Pumphrey, acting for the defendant and also for the Secretary of the Navy, stated that the court action was a menace to national safety in that it threatened to prevent delivery of apparatus necessary to the navy, and would force disclosure of valuable secrets of adjustment and operation discovered by government experts. A letter from the Secretary of the Navy was also submitted to the court presenting the government's desire that its work should not be interfered with.

The case was decided by Judge Hough of the United States District Court, based on a previous ruling of the United States Supreme Court in the case of Crozier *vs.* Krupp, and was affirmed by the United States Court of Appeals to the effect that no cause for action of any kind arises against a contractor to the United States government through the use of a patented invention in carrying out such contracts. The theory basis is that the use of a patented invention by or for the government is a use by the government as a licensee (under an act of Congress of June 25, 1910), and the only recourse for the plaintiff due to such use is by action in the Court of Claims against the government for royalties.

Before the act of 1910 recovery from the government was possible only when an actual license agreement (expressed or implied) existed between the government and the owner of the patent, and therefore in many cases recovery of royalties was impossible. The act of 1910 makes the government a licensee by law whenever it makes use of a patented invention, and provides for full compensation in all cases.

Luminous-Arc White Ways for San Francisco and Salt Lake City

An Illumination Carnival to be held at San Francisco during the first four days of July will mark the initial operation of the new Market Street luminous-arc lighting installation which is being erected with the co-operation of the Downtown Merchants' Association. A distance of fifteen blocks or 1.5 miles will be included in the new illumination district. Ornamental poles at intervals of 110 ft. will each carry three General Electric 6.6-amp. 4500-cp. luminous-arc lamps inclosed in sectional globes with special glassware.

ORNAMENTAL POST FOR SAN FRANCISCO LIGHTING

The Pacific Gas & Electric Company will purchase and install all lamps, cable, rectifiers and other station apparatus at a cost of approximately $100,000. The total maintenance cost of the Market Street system of 411 lamps is estimated at about $33,000 per year.

The top lamps on the standards will be wired on a separate circuit, and will be operated all night long. The two side lamps, which will be operated until midnight, will be paid for jointly by the merchants, property owners, street-car company, and other interests, at an estimated expense of $20,500 per year. Of this amount, the street railway company will pay $6,576, the balance being made up by assessment of merchants and property owners at the rate of $2 per year for each foot of frontage. A decorative top piece designed by Willis Polk, architect, carrying three lamps will replace the present single lamps of the 137 ornamental trolley poles in the Market Street district. The lighting system has been designed by W. D'A. Ryan, formerly chief of illumination of the Panama-Pacific International Exposition.

A similar arc lighting system has been planned for five blocks of the downtown section of Salt Lake City. The property owners will pay for installing and maintaining sixty-four of the three-lamp standards. The estimated total cost of the installation, including cables, lamps, poles, etc., is $28,220. The merchants' share has been raised by issuing bonds.

In the Midst of the "Wire-Your-Home" Campaign

Reports from East and West Indicate Success of Co-operative Movement. House-Wiring Effort to be Extended to May 1 in Cincinnati and Several Other Cities

The first two weeks of the "Wire-Your-Home" Month national campaign which has been set in motion by the Society for Electrical Development, are now past and details regarding the way in which the movement is being carried out in various places are becoming available. The campaign officially started on March 15 and is to continue until April 15, although, as was stated in these columns last week, a number of companies, because of conditions peculiar to their localities or for other reasons, have found it advisable to postpone the campaign for two weeks, and make it include the month of April.

One of the cities in which it has been decided to hold the campaign during April is Cincinnati. Here, owing to the inclemency of the weather and to the inability of those in charge of the campaign to complete arrangements by March 15, it was found necessary to postpone the movement for two weeks. At a dinner held in Cincinnati recently, $1,600 was raised for use in co-operative educational advertising in the local papers to acquaint the public of the fact that during the month of April the electrical dealers and contractors whose names will appear in this advertising will make special prices on house wiring. To this amount, it is expected, there will be added at least another $1,000, or a sufficient sum to make a total of approximately $2,500, which those in charge of the campaign believe will be able to accomplish considerable in the way of wiring old houses. The Cincinnati Electrical Show Company, which conducted the exhibit of electrical goods and devices during Electrical Prosperity Week last year, has decided to offer cash prizes for the best shop windows featuring electrical displays during the first week in April. Three prizes of $25, $15 and $10 in gold will be given.

WIRE YOUR HOME
All kinds of houses—from the most modest to the finest dwellings—are being wired for Electric Service without damage, without mess or fuss, and at small cost.
During Wire Your Home Month—March 15 to April 15—special easy payments may be had.
10 MONTHS TO PAY
FREE
The Youngstown and Sharon St. Ry. Co.
WIRE YOUR HOME. DO IT NOW

FIFTY TELEPHONE INQUIRIES RESULTED FROM THE FIRST INSERTION OF THIS ADVERTISEMENT IN THE YOUNGSTOWN (OHIO) PAPERS

As in Electrical Prosperity Week, the school children of Waycross, Ga., are being enlisted in the campaign. A prize of $5 will be awarded to the high-school student writing the best essay containing not more than 500 words on why your home should be wired for electric light during "Wire-Your-Home" Month. There will also be a special house-wiring contest for high-school students in which the one turning in the largest list of unwired houses in Waycross from which actual customers are obtained will receive a cash prize of $10, the next largest $5, and the third any $5 electric appliance in Boyk's Electric Shop. In addition this contractor will give a premium for every customer obtained during the month, and every customer obtained will receive free his choice either of an electric iron, electric stove or box of Mazda lamps.

The Dayton Power & Light Company, which started its campaign on March 15, has made especially attractive prices for "Wire-Your-Home" Month when the new customer pays 10 per cent cash on signing the contract and the balance in twelve equal monthly installments. The company advertises to wire an eight-room house for $20.43 and a five-room house for the sum of $14.88.

The campaign at the Byllesby properties is being prosecuted vigorously, the local contractors having agreed to make special low prices for the period for wiring unwired houses, and in most cases offering time payments for the installations. The local central stations are doing the advertising, leaving the wiring and financial arrangements to the contractors. As an additional inducement, the central stations are offering free appliances to persons who wire their homes during this month. The results so far indicate that the campaign in these places will be a large success.

The Public Service Electric Company of New Jersey is making every effort to decrease the number of unwired houses in its territory, and is actively co-operating with the electrical contractors in the communities which it serves. The company does no wiring itself, but hands all of its prospects over to contractors. It was stated by the company that there is every prospect of the month being successful throughout the State.

Not only the largest cities but also the very small ones have found it profitable to enter the movement. In Beaver, Pa., a town of under 3500 inhabitants, according to the 1910 census, the electric light company and the contractors have co-operated to reduce the price for house wiring during the month and to allow six months' time in which to pay for the wiring. The campaign is being largely advertised in local papers, and every effort is being made to produce gratifying results.

Chicago Electrical Societies Hold Joint Discussion on Electric Vehicles

At a joint meeting of the electrical section of the Western Society of Engineers, the Chicago section of the American Institute of Electrical Engineers, and the Chicago section of the Electric Vehicle Association, March 27, four fifteen-minute papers on electric vehicles were presented. The speakers and their topics were F. A. Putt, General Electric Company, "Automobile Motor Characteristics;" Gail Reed, Walker Vehicle Company, "Accomplishments of the Electric Passenger Car;" W. G. McDowell, General Motors Company, "The Electric Commercial Vehicle;" and W. F. Hebard, The Buda Company, "Storage-Battery Industrial Trucks and Tractors."

Proposed Franchises to Be Submitted to Dallas Voters

Following the refusal of representatives of Stone & Webster, who operate the traction and lighting companies in Dallas, Tex., to accept proposals contained in the report of E. W. Bemis regarding the issuance of traction and electric-lighting franchises by the city of Dallas to the Dallas Street Railways Company and the Dallas Electric Light & Power Company, Mayor Lindsley and the city commissioners decided that the ideas contained in the report shall be placed before the people of Dallas, together with the charter amendment, at the municipal elections on April 4. If the voters approve the franchises suggested, Stone & Webster will have another chance to accept them. Failing their acceptance, the franchises will be offered to other concerns, it was announced.

The franchise proposed embodied the following ideas:

The electric-lighting property should be capitalized at $3,600,000, upon which the company would be allowed to earn 7 per cent net annually, maximum.

Electric-light rates should be reduced to a figure not determined definitely but which would not be more than 8 cents per kilowatt-hour as against 10 cents per kilowatt-hour at present.

All lighting revenues above operating expenses and allowed net earnings should be devoted to reduction in light rates.

Complete rehabilitation of the electric-light plant and wide extensions of service.

The franchise to be determinate for ten years only. After that period the city would have the right to take over either for itself or some corporation offering better terms both the systems upon payment of a stipulated sum.

Appointment of a public supervisor to represent the interests both of the investors in the properties and of the citizens of Dallas, the supervisor to have jurisdiction in ordering improvement of service and equipment.

Arbitration of differences between the public utilities company and the city.

The entire proposition was rejected by Stone & Webster on the ground that the capitalization and rate of income proposed are both too low. They claimed a value of $5,000,000 each on the light plant and the traction lines east of the river, an aggregate of $10,000,000, and wanted to be allowed to earn 8 per cent upon this capitalization.

Court Decisions in Custom Appeals in Electric Cases

The United States Court of Custom Appeals handed down a number of decisions involving electrical goods on Tuesday of this week in Washington.

In the case of Hirschberg et al. against the United States the merchandise which was assessed by the collector at 30 per cent as carbons for flaming arc lamps, was claimed by the importers to be properly dutiable at 40 cents per 100 ft., as carbons for electric lighting composed chiefly of lampblack or retort carbon. The board of general appraisers overruled the protest of the importers, and the decision of the board was reversed.

In an appeal involving high resistance wire brought by the Bosch Magneto Company, platinum and iridium wire was assessed for duty as wire. The importer protested that it was properly free of duty as platinum in wire. The board of general appraisers overruled the protest of the importer and the decision of the board was affirmed.

Parabolic mirrors which were assessed at 60 per cent as articles of glass were claimed by the importers, the General Electric Company, to be properly dutiable at 11 cents per square foot as cast polished plate glass silvered. The board of general appraisers overruled the protest of the importer and the decision of the board was reversed.

City Files Brief on Valuation of Cincinnati Gas & Electric Property

City Solicitor Groom of Cincinnati, Ohio, has filed with the Ohio Public Utilities Commission his brief in the valuation of the electrical property of the Cincinnati Gas & Electric Company. The commission's tentative valuation was $8,718,541. In his brief Mr. Groom claims deductions should be made from this as follows: $622,552 for interest on the capital stock during the period of construction, $155,638 for taxes during the period of construction, $312,000 for the cost of attaching business and $103,000 from the allowance for preliminary organization and franchise expenses. All of this money, he argues, has been repaid to investors and it should not be included in the valuation. In the item referring to land, buildings and equipment, he claims a deduction of $117,475 and in the item covering substation and distribution, he asks for a deduction of $836,104. These reductions amount to $1,834,768 making the city's valuation $6,883,773.

The company's valuation is as follows:

Present value of physical property used and useful in electric service, including property outside the city, $9,974,201; working capital, $226,852; cost of developing the business, $2,716,765; cost of financing, $2,550,263; value of franchises, $5,581,600; reproduction cost of physical property not used and useful in electrical service, $219,661; total, $21,269,342.

Electrical League of Cleveland Conducts Military Campaign to Double Its Membership

A novel seven-day campaign to double its membership of 500 has been undertaken by the Electrical League of Cleveland, preparatory to taking possession of its new roof-garden clubrooms to be built on the roof of the Hotel Statler.

The campaign was conducted on military plans with two organizations, each commanded by a colonel. Each colonel had ten captains in his divisions and each captain commanded ten privates. In all there were more than 220 actual workers in the field.

Meetings were held daily at Schuster's Café, where each side had a big voltmeter which recorded its "potential" or number of members secured. Much rivalry was developed in the work the first days of the campaign. Novelty was added to the meetings by the special costumes in which the captains and privates were required to appear M. G. Buchan was in general charge as chairman. The division known as the "Volunteers" was commanded by "Col." Herb Snyder, and that known as the "Regulars" by "Col." Hi Green. Daily bulletins were issued, showing the progress of the "drive." The first day's record showed sixty recruits, while next day the line marked 166. A silver loving cup will go to the regimental corps securing the largest number of new members.

The new Electrical League clubrooms on the roof of Hotel Statler will measure 180 ft. by 32 ft., and will contain a main dining room with 2000 sq. ft. of space,

a lounging room 60 ft. by 19 ft., private dining rooms, ladies' reception room and toilet, offices, billiard room, directors' room, baths, men's toilet, coat rooms and all the other conveniences of an up-to-date club. As the elevators reach the roof, there will be full service from the hotel lobby.

The rooms will be inclosed almost entirely in glass, and will be comfortable in the coldest weather, but at the same time they may be opened up in the summer in such a way as to make a complete roof garden when desirable. Table service will be furnished from the hotel kitchen. The league dues are $10 a year.

Engineers Make Formal Declaration for Preparedness

The 3000 engineers who attended the military engineering lectures on March 20 in New York City in a formal expression declared for adequate preparedness in accordance with expert advice. The expression reads as follows:

"The engineers assembled in public meeting on March 20, 1916, under the auspices of the engineers' committee on military lectures, believe that it is unworthy a great nation like the United States and that it is dangerous to the peace, safety and liberty of its people, to remain in our present position of inadequate military, naval and industrial preparedness.

"We believe that between pacifism and militarism there is a just, safe and proper ground, greatly in advance of our present position—a ground which involves large additions to both the navy and army, a large increase in our schools for training officers and a coordination and mobilization of the physical and industrial resources of the nation.

"We believe that this nation should never make war except to inforce peace; that when strongly supported by armed resources its influence in maintaining its own liberties and rights, and the liberties and rights of the weak and oppressed throughout the Americas, will be greatly strengthened.

"We believe that Congress should give due weight to the opinion of experts and should then appropriate sufficient money to put the nation in a position of defense against attack on either the Atlantic or the Pacific Coast.

"We demand that our representatives in Congress act in accordance with this expression."

Bill to Amend Ontario Hydroelectric Commission Act

As a sequel to Provincial Auditor Clancy's report upon the Ontario Hydro-Electric Commission finances a bill has been brought in the provincial legislature to amend the Hydro-Electric Commission Act. The intention of the amendment was to legalize the practice that had obtained for some years. It was moved to amend the act, adding provisions to appoint an accountant under control of the Government who should cover the business relations between the Commission and the Government.

Summarized the new amendments are as follows:

The chief accountant shall have charge of the books of the Commission, and such books shall be open at all times to inspection by any person appointed by the treasurer.

The Commission through its chief accountant shall make an annual report to the treasurer containing the actual amound and character of assets and liabilities; cash transactions, etc. The accounts of the Commission shall be audited by the auditor for Ontario at least once a year.

The income of the Commission shall be applied to the necessary operating expenses; renewals, repairs, and maintenance. The surplus on income, if any, shall be paid by the Commission to the treasurer of Ontario.

Provincial Auditor Clancy, in his report previously submitted to the Ontario Legislature, severely criticizes the accounting and business systems of the Ontario Hydroelectric Power Commission and refers to the disregard of the commission for the provisions of the act under which it was appointed.

He points out that under the provisions of the power commission act "the municipal corporations entering into contracts with the commission shall pay annually to the commission interest upon the amount expended by the commission on capital account in the construction or purchase of the works, all of which the commission shall pay over to the treasurer of Ontario as directed under Sec. 15.

Commission Adopts Own Plan of Accounting

"The commission, however, has disregarded the essential provisions of the act in this respect," observes Mr. Clancy, "and has adopted a plan of its own by substituting itself for the contracting corporations as debtor to the province and undertaking to pay interest on the advances made by the province to the commission instead of or in lieu of the contracting corporations paying interest to the province on the amount expended on capital account.

"This, as might be expected, has led to erroneous interest imposts, and in some instances to inextricable confusion.

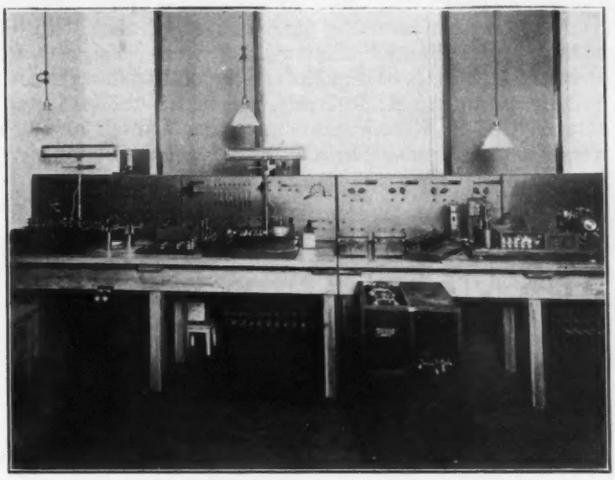
"The work of the commission has not been confined to matters within the scope of its powers and duties, but has been of a very extended character involving large unauthorized expenditures, namely, in entering upon commercial transactions, such as the purchase and sale of goods and material for purposes other than for the necessary use of the several systems, amounting to $455,929; in the construction of works, which under the terms of their contracts the municipal corporations concerned should have constructed, amounting to $883,446; for the electrical construction and maintenance of the London & Port Stanley Railway—a matter in which the municipalities under the provisions of the act respecting hydroelectric railways are alone concerned and are bound to provide the means of carrying on the work—$224,724, making in all $1,564,099.

Excess of Expenditures for Six Years $4,190,621

"The total advances made by the province to the commission for the fiscal years 1909 to 1915, inclusive, amount to $13,169,000, and the total expenditures amount to $17,359,621, showing an excess of expenditure of $4,190,621.

"The annual statements rendered by the commission to the provincial treasurer for the years 1909 to 1915, inclusive, afford no actual accounting information, and fail to disclose the existence of a large and rapidly increasing unauthorized expenditure in the years 1911 to 1915, inclusive, amounting for that period to $4,190,621."

The provincial auditor continues: "The absence of even the semblance of legislative control over the expenditures of the hydro commission" and "the seeming defiant disobedience of the act creating the commission with its powers and duties, with their attendant results, lie at the bottom of the present condition of things."



TABLES FOR TESTS OF PRIMARY STANDARDS

The Electrical Laboratory of a Public Service Commission

The Newly-Installed Equipment of the Pennsylvania Commission at Harrisburg for Testing the Electrical Standards in Use by the Utility Companies of the State

THE Pennsylvania public-service company law which became effective Jan. 1, 1914, and the "service rules and regulations" adopted by the Pennsylvania Public Service Commission on April 9 of the same year, require that every public-service company in the State furnishing service on a meter basis, provide suitable and proper apparatus, to be approved, certified and marked by the commission—for testing and proving the accuracy of the meters used in measuring the service. The law also makes it the duty of the commission to inspect the testing facilities provided by the utility companies with respect to their suitability and adequacy, and to test the standards used by the utility companies to insure their meeting the specific requirements relative to accuracy. The service rules above mentioned pertain to gas, electric, water and heating-service utilities.

Following the adoption of the service rules, consideration was given to several plans whereby the work of standardization would be carried on in the laboratories of the University of Pennsylvania at Philadelphia and the University of Pittsburgh, for the Western portion of the State. This movement finally resulted in the inauguration of electrical testing work in the laboratory of the University of Pittsburgh, where the work was carried on for about a year.

Later it was decided that a single laboratory centrally located, and under the direct supervision of the engineering bureau of the commission, would best serve the ends sought. Accordingly, plans were prepared for a laboratory to be located in one of the State buildings at Harrisburg, and to provide facilities for standardization work in electric, gas and hydraulic fields. The installation has recently been completed and the laboratories have been put into service. In design and execution and in point of convenience of manipulation, the facilities provided by the Pennsylvania Commission for its electrical testing work are of sufficient interest to warrant special description.

The laboratories as installed make provision for the testing of all electrical standards, for the testing of gas-calorimeter equipment, and for miscellaneous testing work in the fields of gas, electric and water utilities. Apparatus has also been provided for the purpose of carrying on inspections and investigations relative to service given by electric, gas, steam heating and water utilities.

NATURE AND SCOPE OF TESTS

The rules of the commission relating to electric utilities require that all electric standards used by the utilities in testing the consumer's meters shall be submitted to the commission for test and certification. This imposes a wide range of testing upon the laboratory, and its equipment must, therefore, be complete. The apparatus tested falls naturally into the usual classifications, that is:

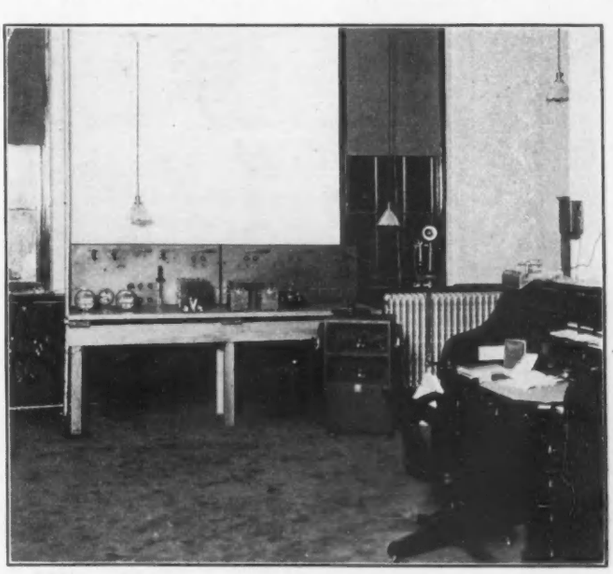
1. Primary standards, which include Wheatstone bridges, volt boxes, and similar resistance apparatus, potentiometers and standard cells.
2. Secondary standards, which include direct-current indicating instruments, with shunts and multipliers, alternating-current indicating instruments, direct and alternating-current reference standard watt-hour meters, and current and potential instrument transformers, on which ratio and phase-angle tests are made.
3. Working standards which may include any of the types of apparatus listed under secondary standards.

In addition the laboratory is equipped with a Reichsanstalt photometer and illuminometer for laboratory and field work.

GENERAL ARRANGEMENT OF LABORATORY

The laboratory occupies two rooms on the first floor, and two rooms in the basement. The larger room on the first floor is devoted to electrical testing, while the smaller room contains the photometric equipment. In the basement are located the storage-battery room, the motor-generator sets and the packing room. The general arrangement of the testing room is shown in the accompanying picture,. It is that of a hollow square bounded on three sides by the switchboard and the test tables, of which there are five in all. The tables each measure 8 ft. long, 30 in. wide and 35 in. high. At the rear of the top is mounted a slate panel 20 in. high, running the full length of the table. On this panel are mounted all of the switches and binding posts required for that table. The tables are placed 3 ft. from the wall, providing easy access to the wiring on the rear of the panels. Each table is particularly adapted to some specific line of testing, although this line of testing is not necessarily limited to that location.

In general, the standards are permanently mounted



A CORNER DEVOTED TO SPECIAL INVESTIGATIONS

in position on the various tables. The supply of energy for laboratory purposes is of special importance inasmuch as the accuracy of many tests depends largely on the constancy of the voltage and current. The sources of power supply provided meet fully the requirements of the testing outlined above and include both direct and alternating current over a wide range of pressures, and from various other sources.

The new standardizing laboratories of the Pennsylvania Public Service Commission were designed by Prof. L. H. Harris of the University of Pittsburgh, consulting engineer; H. B. Pratt, electrical standards tester, and H. E. Ehlers, assistant chief bureau of engineering, the Pennsylvania Public Service Commission.

Beyond the Wire-Your-Home Month Campaign—II

In an introductory article published last week under the above caption, emphasis was laid on the fact that beyond the successful completion of the "Wire-Your-Home" Month campaign, the electrical contractor and central-station man should be prepared to bring to maturity that half-grown house-wiring business initiated by the activity of the month's campaign, yet not "closed" before the end of the campaign period, April 15. Only through such prolonged, consistent effort can be realized the full value of the intensive work of the campaign month now in full swing. In the issue of last week were presented accounts of a group of successful, sustained house-wiring campaigns in New England. On this and the following pages are told the stories of several other prolonged result-producing campaigns conducted in cities of the Middle West.

How Elkhart Waged a Year-Long Wiring Campaign

A Sustained House-Wiring "Drive" in Which Cartoon Advertising, Co-operation with Contractors and the Enthusiasm of the Company's Employees Brought Big Results

ELKHART, Ind., in 1915 boasted of a population of about 22,000, and 99 per cent of its commercial buildings were wired and were using electric light. But of this Hoosier city's 5000 dwellings less than 3000 were enjoying the service of the local central station, one of the chain of plants of the Indiana & Michigan Electric Company. Its residence customers

HAVE YOUR HOUSE WIRED FOR ELECTRICITY

Here's Your Opportunity to Secure

UP-TO-THE-MINUTE

Lighting Equipment in Your Home at an Extremely Low Figure

Houses Equipped for Electric Service BELOW ACTUAL COST

We Pay the Contractor's Profit and Also 25% of the Cost of Fixtures

Take Advantage of this Offer

NOW

Which Applies Only to Houses Already Built

Phone 113 or 239 for Details

INDIANA AND MICHIGAN ELECTRIC COMPANY

A NEWSPAPER ADVERTISEMENT PRESENTING THE COMPANY'S OFFER

were too few, and it was apparent that a house-wiring campaign was needed. The company therefore decided to put one on—not a campaign of the "flash-in-the-pan" kind but a good, long, concentrated heavy hammering effort that would carry its impulse around the calendar, with a series of hard drives to round up every possible customer.

Accordingly the local electrical contractors were called in, and before they left the conference they fully understood that the central-station company was determined to develop a large amount of house-wiring business, and as their part in the affair offered to do the wiring, since the electric company had no wiring department. It was further agreed that the customers who signed contracts for electric service were to choose their own contractors and that the contractors would estimate each job separately. But after the estimate had been made, based on the contractor's regular schedule of prices, 25 per cent was to be deducted from the total in all cases where this did not exceed $50; where it did exceed $50 only $12.50 was to be deducted. The regular schedule price less this discount was to be quoted to the prospective customer, and if he accepted the bid, then the amount of the discount was to be charged to the central station. In other words, the central station agreed to pay 25 per cent of each new customer's wiring bill up to the amount of $12.50. Time payments, to be carried by the contractor taking the business, were to be offered to customers at his discretion.

The central station agreed to do the advertising, and during the year 1915 the company inserted thirty-eight full-page advertisements in each of the two daily papers, while three contractors were each induced to use a full page once, making in one issue a four-page spread on house-wiring. The company also reproduced many of its full-page advertisements in smaller space after they had been used as full pages so that during the year it used space in all 239 times and in 78 per cent of all issues of these papers. In Elkhart the first insertion of a full-page advertisement costs $21.50 and a second insertion of the same "copy" costs $10.75.

But the character of this advertising as well as the quantity of it was a big factor in its success, according to J. P. Ohmer, manager of the property. His idea was to make his advertising "catchy." He wanted every one who read a paper to see it. He wanted readers to get at a glance the message that every house should be wired, to remember what they had seen, and perhaps to be pleased enough with the "ad" to smile or chuckle a bit at the wit of it. Cartoon advertising, therefore, seemed to present the problem's solution. So Mr. Ohmer developed the ideas for the cartoons, and O. P. Bassett,

owner and editor of the Elkhart *Daily Review*, executed them. This kind of advertising was carried on throughout most of the year. At one time the price-reduction offer was, after due notice, brought to a close, but it was soon resumed, because the idea of withdrawing it was the belief that the warning of discontinuance would induce those "prospects" who were wavering to sign contracts at once. The satisfactory increase in contracts just prior to the time of discontinuance proved that those who made the plan had understood the mental processes of the ordinary thrifty Hoosier.

The campaign did not stand on newspaper advertising alone, for it was firmly backed by a direct advertising campaign and a hard-working force of salesmen; but the direct advertising was unique in that all the residences in town—5000 of them—were circularized. The circulars consisted mainly of reprints—minus the date line—of the full-page advertisements folded and placed in large envelopes which had some catchy phrase printed in red ink on the outside. Sometimes red ink was used to print the circulars, for Mr. Ohmer thinks that red ink pays big dividends. These circulars were distributed by the salesmen, driving horses and wagons and aided by young men who did the actual work of carrying the bills from the wagon to the houses. This work was given to the salesmen because it was essential that it be supervised by responsible persons who would not at the first opportunity throw the entire set of circulars into the St. Joseph River. The solicitors were paid straight salaries and no commissions.

Mr. Ohmer was very often asked: "Why do you send those circulars to me? I use electric light." To this he good-naturedly replied that he was sending them to everyone, which was the truth, for he discovered that the reprints cost only 1 cent each delivered and that he could not make a list of the non-users of electricity and circularize them alone as cheaply as he could include every one. Then, too, he figured that it was worth something to have every man, woman and child in town thinking, talking and wondering about what the electric company would probably do next.

In name the sales department consisted of the commercial manager, three salesmen and a special man who kept the "loose ends" picked up. In reality the sales department was limited only by the number of employees of the company, for every employee was a booster. Even the janitor worked up a number of "prospects" in his neighborhood, and a solicitor went out in the evening and closed the contracts. The office girls watched over the new-business barometer—a chart showing the net gain in new customers daily—and became saleswomen as well as clerks. The linemen helped. In fact, everyone did his part, and the enthusiasm of the organization may perhaps be best appreciated when it is stated that the majority of the contracts

Watch Your Step! Safety First!
Here's a Suggestion for an Investment That May Pay You 1000 Per Cent, Especially if There Should Be Broken Bones
Have you ever heard this phrase upon entering the basement to fix the furnace fire:
"Now, be careful; you know that's such a dark, ugly step!"
Can you recall having heard these words upon entering the cellar after a pan of apples:
"Better take a few matches or a lamp with you"?
If you will only make tracks, like John, in just a day or two, there will be no anxiety on mother's part, as expressed in the picture. No dark cellar steps. No further necessity for lamp or matches. Can you really afford not to follow in John's footsteps before you are in his fix? The cost is nothing, returns considered.
Indiana & Michigan Electric Company

ONE OF THE FULL-PAGE CARTOON ADVERTISEMENTS USED IN THE ELKHART CAMPAIGN

were closed in the evening when the men of the households had returned from their work at the factories.

Under the plan as it was arranged, the salesmen's work was not completed when the contracts were signed. They had to see that the prospective customers did not "back out" when the contractor quoted his price. So the salesmen naturally made appointments with signed customers to meet them at some contractor's shop to pick out fixtures. The fixtures, however, were sometimes the stumbling block. At the beginning of the campaign the electric company had counseled the contractors not to buy expensive fixtures and glassware but to lay in a stock of pendent chain fixtures, and when the salesman met a woman customer to assist her in

In addition to the campaign of full-page newspaper advertisements and circulars distributed among the homes of both prospective and present customers, the Elkhart company made good use of electric-lighted billboards to give publicity to its house-wiring "drive." The display illustrated was operated by a flasher which turned it "on" six seconds, and "off" two seconds. These signs, of which there were several, did a great deal to increase residence business.

HOUSES WIRED DURING 1915 WITHIN CORPORATE LIMITS OF ELKHART, IND.

1915	Connections	Contractor No. 1	Contractor No. 2	Contractor No. 3	Contractor No. 4	Total
January	8	5	2	.....	.....	7
February	5	3	.....	.....	.....	6
March	9	9	.....	.....	.....	13
April	71	23	39	.....	.....	62
May	123	33	70	2	6	111
June	85	21	68	.....	3	92
July	76	17	37	1	4	59
August	69	22	36	2	2	62
September	82	14	30	.....	3	47
October	99	7	28	.....	3	38
November	64	15	29	.....	3	47
December	30	12	11	.....	.....	23
	721	181	350	5	24	567

selecting fixtures he did his utmost to facilitate the sale of proper inexpensive equipment. He pointed out the advantages of the pendent chain design, showed her that it carried less glassware to be kept clean, explained that with such a fixture there would be less likelihood of breakage, and generally concluded his advice with the statement that while it was true that pendent chain fixtures were less expensive than four-lamp fixtures, the manager of the electric company himself had only recently thrown out all three-lamp and four-lamp fixtures from his home and installed the pendent chain type. The result generally was that the fixture bills were low; hence the entire price was low, and few customers changed their minds when they heard what it would be.

THE PROBLEM OF FIXTURES

At first the contractors rather resented the assistance which the salesmen gave to the customers in selecting low-priced fixtures, but when they were made to see that those who could afford high-priced fixtures would buy them later and that all who became users of electricity at once would be possible purchasers of equipment and repairs, just so much sooner they agreed with the central-station man's point of view. The result in the aggregate was that 25 per cent of the houses wired in 1915 were equipped with pendent chain fixtures.

The result of the campaign by months is given in the accompanying table, which shows how consistently the work kept up from spring to winter. During the year the four contractors of Elkhart wired in all 567 houses on contracts secured by the electric company, and in all the company gained 721 customers, 161 customers being added through building new houses and reconstructing old ones. Hence at the end of December, 1915, the central-station had succeeded in connecting 3611 of its available 5000 residences to its lines and had a total of 4317 meters in service, making the motor diversity about one for every five persons. This record the company is justly proud of, in view of the fact that the city primarily is a railroad and manufacturing center.

AVERAGE HOUSE-WIRING BILL $41.14

The total average cost of wiring the houses in this campaign was $41.14, so that the contractors interested had among them a gross house-wiring business of about $23,700 for the year. The central-station company, in accordance with its offer, paid the contractors the 25 per cent discounts, and the average discount per house was $9.22. The central station's annual increase in income from the 721 new customers is in the neighborhood of $15,000, and the cost of securing this business was $11,025.26, divided as follows: Advertising, $2,388.47; salesmen's salaries, $3,409.05; discount paid to contractors, $5,227.74. It may be of interest to note also that when the spring rush of business came the contractors had not the men in hand to handle the work properly and the electric company took upon itself the task of finding and importing from nearby towns competent wiremen to work for the contractors. Everybody tried to help everybody else in his time of particular trouble and there was thorough harmony.

Another point that is interesting to consider is that the first two months of this year—1916—have shown that, unlike many campaigns, this development in Elkhart has had a most agreeable after-effect. As will be noted from the table, the number of customers gained in January and February of 1915 while things were getting under way was seven and six respectively, while in the corresponding months of 1916, while the company's salesmen were engaged in making a house-to-house canvass to revise the card index of customers and prospective customers, the number of customers gained was: January, 39; February, 93. The movement forged ahead by its own momentum. There has been no resting on the oars after a successful year, and neither Mr. Ohmer nor W. R. Riblet, the commercial manager of the Elkhart central station, intends that there shall be.

All-Year-Round Campaign a Feature in St. Louis

The importance of a consistent, round-the-calendar pursuit of prospective wiring customers is recognized and made the very basis of the effort in St. Louis, Mo.

"We are not conducting any special campaign this spring on already-built houses," said F. D. Beardslee, sales manager of the Union Electric Light & Power Company of that city, "but are continuing our regular all-year-round campaign. Under our plan contractors are paid commissions for wiring houses and securing

A GRAPHIC METHOD OF TELLING THE HOUSE-WIRING STORY AT ST. LOUIS

customers for us. If the prospective customer cannot afford to pay cash for wiring and fixtures, the Union company finances the work and permits the customer to pay for his installation monthly with bills for service.

"We consider that this plan is showing excellent results since the number of houses wired under it is increasing from month to month. This spring, as during

every spring, we are advertising in the newspapers and utilizing our illuminated bulletin boards to stimulate the wiring of already-built houses. We do not feel that the wiring of already-built houses should be attacked in a spasmodic campaign, but think that it should be handled as a regular matter of business from month to month. Then when spring comes it is possible to secure the accumulated benefit of the missionary work done during the winter months."

House-Wiring Results of a 300-Day Campaign Featuring "Kitchen Service" at Dayton, Ohio

BY THOMAS F. KELLY
Commercial Manager Dayton Power & Light Company

On April 19, 1915, through advertising in the newspapers and by means of a two-color, four-page folder which was distributed through personal visits of our residence salesmen to prospects, "electric kitchen-service" was introduced in Dayton, Ohio.

The Dayton "electric kitchen-service" consists of one key socket and drop cord, a 40-watt tungsten lamp, one side-wall outlet, and a 6-lb. electric iron. Ready for use its costs but $10.98 cash. The wires enter the premises in metal conduit. The wiring is all concealed. The meter and fuse box are set according to standard practice in the cellar and the box has sufficient capacity to accommodate future permanent wiring. The entire kitchen service was designed for permanency.

When any orders for "electric kitchen-service" are secured by our salesmen they are turned over to a contractor, who satisfies himself regarding the credit and collects from the customer when the work is completed. The kitchen-service proposition has been a wedge to get electric service introduced into a home when our other efforts failed.

The contracts closed covering "electric kitchen-service" business is a small portion of the business obtained through this proposition. Since the "electric kitchen-service" proposition was placed on the market—that is, during the past ten months—1276 old houses have been wired in Dayton for electric service, but our records do not show how many owners became interested first in our kitchen-service proposition, and then through salesmanship and the opportunity thus afforded were convinced that the proper thing to do would be to wire their houses for complete electric service.

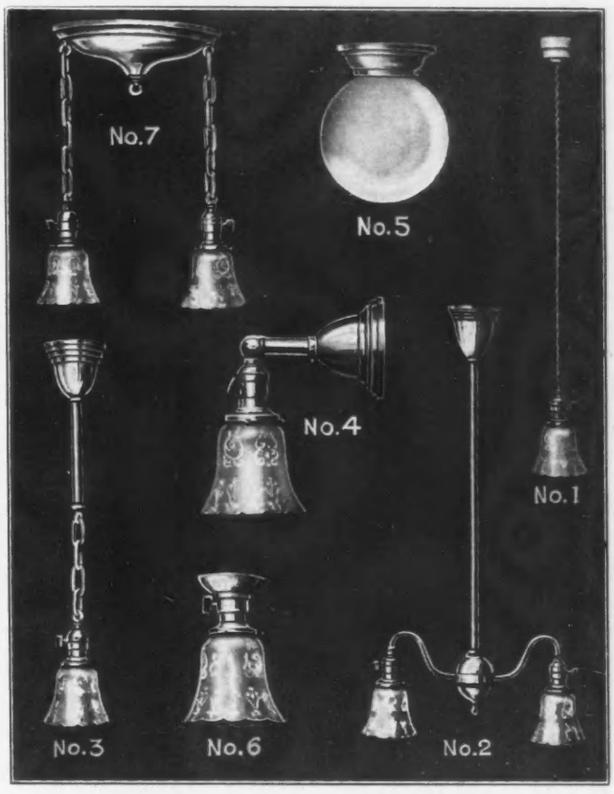
The books of the electrical contractor who is co-operating with the Dayton Power & Light Company on this work show that approximately 25 per cent of the "electric kitchen-service" customers have spent amounts varying from 75 cents to $26.47 with the contractor in addition to the $10.98. These people, who after they had signed the "electric kitchen-service" contract decided at the solicitation of the representative of the electrical contractor to wire their entire houses, are not considered "electric kitchen-service" customers.

Unfortunately, the offer has not been in force for one year and therefore data to show what is the annual revenue from any of these customers is unavailable. However, the average monthly revenue during the past nine months, taking about 20 per cent of the total customers as an average, has been $1.08 per customer. No record has been kept of the number of "electric kitchen-service" customers who have completed the wiring of their homes since the meter was installed, although it is possible that some have completed this work. A good deal of this extension business is expected this year, and the electrical contractor intends this month to put concentrated effort into securing this extension work. The visit of his salesman will be followed up by a representative of the Dayton Power & Light Company.

To the best of my knowledge we have not lost a single "electric kitchen-service" customer. It is true that we cannot hope for any great revenue from these customers, and yet I believe an "electric kitchen-service" proposition is good business and affords an excellent entering wedge to obtain the ultimate business from all of our unwired houses.

How a Continuous House-Wiring Campaign Is Carried on at Dubuque, Iowa

The Union Electric Company of Dubuque, Iowa, has in the files at its office a complete report on each unwired house, apartment and store in the city. The names of the occupants of these buildings have been placed alphabetically in an addressograph list so that they can be readily circularized periodically. The town has been divided into territories so that each of these prospective



ON THE OTHER SIDE OF THIS SPECIFICATION SHEET, WHICH PICTURES THE VARIOUS FIXTURE OFFERS OF THE DUBUQUE CAMPAIGN, IS A TABULATION FOR THE EASY ESTIMATING OF WIRING COSTS

customers also receives at least three personal calls a year from a representative of the company's sales department. These salesmen carry a schedule of wiring prices agreeable to all local contractors, and in selling wiring to customers give them the privilege of either accepting a time-payment plan or taking a liberal discount for cash. Duplicates of the contracts are given to the contractors in rotation and are used by them as working orders. The contractors are paid by the central-station company every thirty days. The solicitors also carry specification sheets which show illustrations of standard fixtures on one side and which are arranged for easy estimating of wiring costs on the other side. Whenever possible the solicitor makes out the estimate side of this card and leaves it with the price of wiring at the home of the prospective customer.

Street Lighting on a Cost-of-Service Basis

An Indeterminate-Contract Plan by which the Municipality Assumes Responsibility for the Operating Company's Special Street-Lighting Investment—Abstract of a Paper Presented before the Wisconsin Electric Association, March 16

BY G. W. VAN DERZEE

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ONE of the most perplexing problems confronting the utility to-day is that of street lighting. It is a problem so intimately connected with public sentiment that its satisfactory solution usually requires expenditures of time and money on the part of all concerned quite out of proportion to the cost of the service or the value of the business.

It is the author's purpose in this paper to describe certain fundamental principles of rate-making and a form of street-lighting contract which will materially improve conditions in the future. The contract proposed is designed to provide street-lighting service on a cost-of-service basis to the municipality, in consideration of a guarantee by the municipality against financial loss to the utility.

To illustrate in brief detail the sequence of processes involved in the determination of rates and selection of the most favorable type of contract, a hypothetical case of a city of 40,000 inhabitants has been selected. It is assumed that the previous contract for street lamps has just expired and a careful study of the situation has shown that it is desirable to replace the present lamps and their supports with new and improved lamps hung in the same location as the old. This situation permits the use of existing facilities, such as wire, poles, special street-lighting station equipment, etc., and thus insures the municipality at the outset the lowest possible rates for service in the new contract.

We proceed first with a separate valuation of the physical property of the utility which is used exclusively for street-lighting purposes, called "special street-lighting investment," and that used jointly for street lighting and commercial or railway service, called "joint street-lighting investment." Special street-lighting investment, of course, includes equipment used exclusively for street-lighting purposes. This investment can be summarized as in Table I.

TABLE I—VALUATION OF SPECIAL STREET LIGHTING EQUIPMENT

Item	Unit	Quantity	Cost of Reproduction	Present Value
Poles	Each	1,000	$15,000	$10,500
Wire	Feet	360,000	10,800	8,100
Crossarms	Each	750	750	375
Pins and insulators	Contact	3,000	480	432
Lamp supports	Each	600	3,000	3,000
Lamps	Each	600	6,000	6,000
Constant-current transformers	Each	12	6,000	4,200
Total	.....	.....	$42,030	$32,607
Total plus 15 per cent for overhead expense			$48,335	$37,498

The difference between the total cost of reproduction, $48,335, and the present value, $37,498, namely, $10,837, is the amount that should have been provided in the previous rates for street lighting to cover depreciation.

VALUATION OF JOINT EQUIPMENT

Joint street-lighting equipment includes the proportion of poles, conduit, cable, power-plant equipment, etc., used jointly by street-lighting, commercial or railway service, and chargeable to street-lighting service. The "contact" basis of apportionment is used in computing the percentage chargeable to street lighting. For example, there may be four "contacts"—three commercial service and one street-lighting. In such a case the cost of the pole and crossarm is therefore chargeable 25 per cent to street-lighting and 75 per cent to commercial or other service. Stated differently, assuming that the pole and crossarm cost $16 erected, only $4 of the total is charged against street-lighting investment, instead of $16, which would be necessary if there were no other service to share the expense.

To obtain the proportion of the investment in jointly used power-plant equipment chargeable to street lighting, the entire investment in jointly used power-plant equipment must be computed. Assuming that this joint investment gives a cost of $100 per kilowatt of maximum demand, on the basis of 350 watts' demand at the station, per lamp, the power-plant investment chargeable to street lighting becomes $600 \times 0.350 \times \$100 = \$21{,}000$, as set down in Table II.

TABLE II—VALUATION OF JOINT STREET LIGHTING EQUIPMENT

Item	Unit	Quantity	Cost of Reproduction	Per Cent Chargeable to Street Lighting	Amount Chargeable to Street Lighting
Poles	Each	2,350	$35,250	25	$8,813
Crossarms	Each	2,000	2,000	25	500
Power-plant equipment	Kw.	210	.....	..	21,000
Total					$30,313
Total plus 15 per cent for overhead expenses					$34,860

In any well-constructed rate for street-lighting service, every element of the fixed charges and operating expenses must be included.

COMPONENT PARTS OF RATE

Fixed charges include interest on the investment of the utility in street-lighting equipment, an allowance for depreciation to cover replacement of worn-out or obsolete parts of the joint street-lighting investment, and a yearly rate of amortization of the special street-lighting investment sufficient to return to the utility during the term of the contract an amount equal to the cost new of special street-lighting investment, less the scrap value. In addition are the charges to cover taxes and insurance expressed as a function of the investment.

Operating expenses include the busbar cost of energy required for the lamps, operating supplies required to keep the lamps burning, such as lamp renewals, carbons or electrodes, as the case may be, maintenance of street-lighting station apparatus, lamps and distributing circuits, trimming and patrolling service and the proper share of the general and undistributed expenses of the utility.

It has been common practice for a utility to enter into a contract for street lighting with a municipality for a definite period, ranging usually from five to ten years. The utility was compelled to so figure its rates under a term contract that at the end of the contract it had received in the rates charged a sufficient amount to amortize the entire cost new of the special street-lighting equipment, less scrap value.

It is evident, however, that an ideal form of contract cannot be for a definite term, but must provide for the supply of street-lighting service on a cost basis

and for an indeterminate period, or until such time as the municipality desires to terminate the contract. The condition of termination, where service is rendered on a cost basis must necessarily be, that the municipality guarantee the integrity of the utility's investment in special street-lighting equipment devoted exclusively to street-lighting purposes. Such a form of contract is now possible under the Wisconsin statutes, as provided by Chap. 490, Laws of 1915.

COST OF SERVICE CONTRACT

In a "cost of service" contract, the investment is divided into two parts, "special street-lighting investment" and "joint street-lighting investment." The operating expenses are likewise divided into two parts called "direct operating expenses" and "joint operating expenses." The "direct operating expenses" include those operating charges which are directly assignable to street lighting and are not apportioned parts of a similar expense shared by other branches of the business of the utility. Such expenses include trimming and patrolling, maintenance of lamps and special station equipment, renewal of lamps, carbons or electrodes, and any other operating costs directly incurred in the operation and maintenance of the special street-lighting equipment.

Joint operating expenses are defined as those expenses in the operation of the utility which are jointly incurred for street-lighting or other service. Such expenses include cost of power generated or purchased, the cost of its transmission, transformation and distribution and the proper portion of general and undistributed expenses of administration and supervision.

For ready reference, we shall refer to the four elements of the rate as follows:

	Per Lamp-Year
A. Fixed charges on joint street-lighting investment	$....
B. Joint operating expenses	$....
C. Fixed charges on special street-lighting investment	$....
D. Direct operating expenses	$....
Total annual charge	$....

The method of obtaining these four divisions of cost is very simple, knowing the special and joint investments and the operating expenses of the type of lamp proposed. Special and joint investments have previously been determined by valuation to be the following:

	Cost of Reproduction		Present Value	
	Total	Per Lamp	Total	Per Lamp
Special investment	$48,335	$80.56	$37,498	$62.50
Joint investment	34,860	58.10	.....	.....
Total investment	$83,195	$138.66	.....	.....

The lamps are assumed to be 300-watt nitrogen-filled lamps burning 4000 hr. per year.

A. Fixed Charges on Joint Street-Lighting Investment.

The fixed charges listed under this heading include interest, depreciation, taxes and insurance, amounting in total to $7.55 per annum, which is 13 per cent of the joint investment of $58.10.

These charges are as follows: Interest, 6 per cent; depreciation, 5 per cent; taxes, 1½ per cent; insurance, ½ per cent.

Interest at 6 per cent is assumed equal to the actual average cost of money, having in mind the guarantee to be given by the municipality as to the integrity of the utility's investment in special equipment. Under a definite term contract, nothing less than 8 per cent as a proper interest rate should be considered. Depreciation at 5 per cent is a normal figure, as are taxes 1½ per cent, and insurance ½ per cent.

B. Joint Operating Expenses.

The operating expenses listed under this heading include the following:

	Per Lamp-Year
Energy at busbar cost	$11.20
Maintenance of joint transmission and distributing lines	1.25
General and undistributed	2.50
Total joint operating expenses	$14.95

Annual costs so far considered are all of a joint nature and amount to $22.50 per lamp-year. The investment is such that it would in no way be affected by discontinuance of the street-lighting business. The municipality pays a reasonable rental for that part apportioned to its use and reasonable rates for the joint service performed for street lighting. These costs are subject to such review as may be secured and provided from time to time under the utility law.

C.—Fixed Charges on Special Street Lighting Investment.

Fixed charges appearing under this heading are 13 per cent of the special investment of $80.56 per lamp and amount to $10.47 per lamp-year. The rates of interest, depreciation, taxes and insurance are identical with those used in computing the fixed charges on the joint investment.

The municipality is to guarantee the integrity of the entire special investment. In the case under discussion the special investment devoted to street lighting at the beginning of the operation of the contract amounts to $48,335, and there has been set up through the old rates a reserve to insure replacement of such special investment, the difference between the amount of the investment and its present value, $37,498, or $10,837. The municipality is given credit for the accumulated reserve and assumes an obligation only for the present value of the special equipment.

The utility agrees to account separately for the special investment, making additions thereto from time to time where added special investment is required by order of the municipality under this contract and deductions therefrom from time to time where special investment, no longer used and useful, has been retired from service. The utility also agrees to account separately for the depreciation reserve accumulated to insure replacement of special investment equipment, making additions thereto from time to time as provided by the depreciation element in the fixed charge of 5 per cent and an addition of interest on balances at some agreed rate, such as 3 per cent.

Deductions would be made from depreciation reserve from time to time equal to the cost of special investment less scrap or recovery value, no longer used and useful and retired from service.

The fixed charges on the special investment per lamp per year would be revised annually at the end of each year by computing 13 per cent of the special investment per lamp as found at the end of each year. The amount so found becomes the charge for this element in the rate for the ensuing year.

D. Direct Operating Expenses.

The costs included under this heading are as follows:

	Per Lamp-Year
Trimming and patrolling	$2.50
Lamp renewals, two and one-half per year	8.00
Maintenance of lamps	.75
Lighting circuits and plant equipment	2.00
Total direct operating expenses	$13.25

The utility agrees to account separately for such direct operating expenses, and this part of the cost will be revised at the end of each year to conform to the actual cost for the contract then expired, and such revisions will be applied to the rates for the ensuing year.

The sum of costs A and B, as revised from time to time pursuant to the public utility law, and costs B and C as revised annually, will constitute the price payable by the municipality to the utility for street light-

ing service under a "cost-of-service" contract during each year. The total cost per lamp-year for the first year may now be computed:

	Per Lamp-Year
A. Fixed charges on joint street-lighting investment	$7.55
B. Joint operating expenses	14.95
C. Fixed charges on special street-lighting investment	10.47
D. Direct operating expenses	13.25
Total "cost-of-service" contract rate	$46.22

To insure the proper accounting for the various operating expenses under a "cost-of-service" contract, the utility would submit under oath if desired annually within thirty days after the completion of each contract year:

1. A statement of account of the special investment in street-lighting equipment;

2. A statement of the reserve accumulated to insure the replacement of such investment;

3. A statement of the costs incurred during the year in the operation of the special investment devoted to street-lighting service; and

4. A statement of the resulting adjustment in rates for the succeeding year.

The municipality should have the right to audit the records of the utility upon which the foregoing statements are based.

To guarantee the integrity of the special investment, the municipality would agree that, upon termination of the contract, at its election, it would pay the utility the difference between the cost of special investment in street-lighting equipment less scrap or recovery value, and the depreciation reserve accumulated to insure the replacement of such equipment, as accounted for by the utility as at the date of such termination of contract.

The foregoing statements describe briefly the important features of the "cost-of-service" contract. Comparisons will now be made of the rate of $46.22 per lamp-year under the "cost-of-service" contract with the rates which would have to be charged on a five-year and a ten-year contract.

In any form of contract, the operating expense portion may be considered to be the same as in any other form of contract for the same service. On more careful analysis, however, we find that the operating expense portion of the "cost-of-service" contract rate is subject to revision annually and the revision is much more likely to be downward than upward, due to the constantly increasing economies being effected in operation. For this reason the operating expense portion of the "cost-of-service" contract rate over a period of years is likely to be considerably less than the operating expense portion of the definite-term contract, which remains fixed in amount and had to be computed to take care of any contingency, as there is no recourse for the utility or contractor under a term contract once the contract is signed at a flat rate.

COMPARISON OF ANNUAL RATES OF CHARGE UNDER DIFFERENT FORMS OF CONTRACT

	5-Year Contract	10-Year Contract	"Cost of Service" Contract
Interest, 8 per cent	$11.09	$11.09	$8.32
Depreciation, 5 per cent	2.90	2.90	6.93
Amortization of special investment	11.24	5.62	None
Taxes and insurance	2.77	2.77	2.77
Operating expenses	28.20	28.20	28.20
Total	$56.20	$50.58	$46.22
Comparison if all equipment were new	$59.82	$52.39	$46.22

In a term contract, interest, taxes and insurance are computed at a percentage of the entire investment. Depreciation is computed on the joint investment at 5 per cent or higher, and the depreciable part of the special street-lighting equipment is amortized over the period of the contract. The above table shows a comparison of the annual rates of charge under different forms of contracts, each form of contract to give the utility about the same guarantee of integrity of its investment.

In figuring the amortization of the special equipment, the present value of such equipment has been used, namely, $62.50 per lamp, and the scrap value has been figured at 10 per cent of that amount. This leaves an amount of $56.25 to be amortized over the period of the contract. Had the equipment been new, the amount to be amortized would have been the cost of reproduction per lamp, $80.56, less the scrap value, $6.25, which equals $74.31. This materially increases the total cost per lamp-year under the five-year and ten-year contracts and brings out more clearly the real advantage to be gained by the municipality in cost under the "cost-of-service" contract.

From a close analysis of the advantages of the "cost-of-service" contract as compared with the term contract, the following conclusions may be drawn:

1. The rates per lamp-year under a "cost-of-service" contract will average 10 per cent lower than those that can be offered under a ten-year contract and 20 per cent lower than those under a five-year contract.

2. The utility is guaranteed the integrity of its special street-lighting investment and, therefore, is able to offer the municipality street-lighting rates at actual cost.

3. The rates include only normal allowances for depreciation and no amortization of special equipment made necessary in a term contract.

4. The municipalities will profit year by year in any economies practised by the utility, due to the annual adjustment of direct operating expenses.

5. As the number of lamps in the municipality increases, the tendency is for the average spacing to decrease, which will lower the average special investment per lamp and decrease the element of fixed charges on the special street lighting investment.

6. No limiting conditions of spacing of new lamps from nearest existing lamps need to be imposed in the contract, as the municipality has the privilege of specifying lamps at any location it desires and pays the entire cost therefor to the utility.

7. Lamps may be moved or removed, service may be changed from overhead to underground, new types of lamps may be substituted for the old at any time the municipality desires, but the full cost of making any such changes is borne entirely by the municipality, the utility doing the work at cost.

8. The municipality receives all of the advantages it could claim under municipal ownership and none of the disadvantages.

9. Periodic controversies over rates, contracts, etc., will be avoided.

10. The municipality secures full benefit of joint use of investment and operating organization of the utility on a division of cost rather than upon a duplication of investment and operating organization basis. It reaps full partnership benefit without risk or use of capital and without managerial effort or responsibility.

The utility is vitally interested in the prosperity of the municipality. Decreased rates, under the "cost-of-service" contract, eventually mean more lamps. More lamps mean a better lighted and advertised municipality, which, in turn, ultimately means more business for the utility. The time has come for better mutual relations between the municipality and the utility. The utility should share in the support and encouragement given by the municipality to its industries. In turn, the utility should share with the municipality the results of any increased economy which it is able to effect in the service it renders the municipality.

The adoption of the "cost-of-service" contract opens the way for an important step in that direction.

Operation of a Small Ohio Transmission System

Line Construction and Plant Operating Methods Used by a Group of Small Interconnected Properties Serving Several Ohio Towns

THE Ohio Light & Power Company of Newark, Ohio, a subsidiary of the American Gas & Electric Company of New York City, operates nearly 100 miles of transmission lines in the form of a loop extending southward from Newark to Logan, Ohio, a distance of about 45 miles, connecting Lancaster on the southwest and New Lexington, Crooksville, New Straitsville and other towns on the southeast from Newark, as shown on the map on page 762. The company also serves Mount Vernon, about 30 miles north of Newark. These towns are active commercial and industrial centers and furnish a diversified load. Crooksville, New Lexington, Shawnee and New Straitsville furnish industrial loads incident to the mining of coal and the operation of clay-working plants, Crooksville alone having seventeen potteries. At Corning and along the transmission lines between the other towns the load of the mines themselves is available. Throughout the whole territory the lines of the company traverse a fertile agricultural section from which a heavy rural lighting and power load is ultimately expected. The population of the cities reached and other data on substations serving them, as well as auxiliary plants operated, are given in Table 1.

The company's interconnecting transmission system operates at 66,000 volts and at present, except in emergencies, takes energy only from the power house at Newark. From each substation the company has started to build a four-wire, three-phase distribution network operating at 4000 volts, 60 cycles to develop the local territories within a radius of 8 miles or 10 miles of the station. With the transmission line loop completed the service to all towns will be strongly fortified against interruptions, since the operation of a plant at Newark and a gas engine station at Logan, at the ends of the transmission loop, permits the isolation of line trouble, so that any town can be supplied from either of two directions.

ECONOMIES EFFECTED AT THE NEWARK PLANT

Among the many properties of the American Gas & Electric Company the Newark plant holds the record for the lowest percentage of combustible in its ash. The boiler plant is operated at 200 per cent of its rating and the average combustible lost is 2 per cent. The reasons for these good records are as follows: 1. The firemen are not allowed to shake carbon through the fire. 2. The practice of firing but one furnace door at a time is insisted upon. 3. A high stack and conse-

TABLE I—DATA ON GENERATING STATIONS AND TRANSMISSION SYSTEM OF OHIO LIGHT & POWER COMPANY

Town	Interconnected	Population	Customers	Type of Prime Mover	Rating of Station, Kw.	Ultimate Substation Rating, Kw.
Newark	Yes	26,000	2,000	Turbine	4,300	6,000
Thornville	Yes	500	....	.....	switching	station
Lancaster	Yes	16,500	1,000	Steam engine	400*	2,000
Logan	Yes	6,000	600	Steam replaced by gas	225-705*	1,200
New Straitsville	Yes	3,000	....	.....	.....	300
Shawnee	Yes	3,000	400	Gas	100*	1,200
New Lexington	Yes	3,000	600	Gas	150*	1,200
Crooksville	Yes	3,300	350	Energy purchased	500*	1,200
Mount Vernon	No	12,500	1,000	Steam turbine	875	.....
Corning	No	1,200	....	.....	.....	600

*Operation of plant discontinued.

	Miles		Miles
Newark to Lancaster	36	New Straitsville to Shawnee	2
Newark to Mount Vernon	30	Shawnee to New Lexington	8
Newark to New Lexington	29	New Lexington to Crooksville	9
Lancaster to Logan	18	Shawnee to Corning	7
Logan to New Straitsville	12		

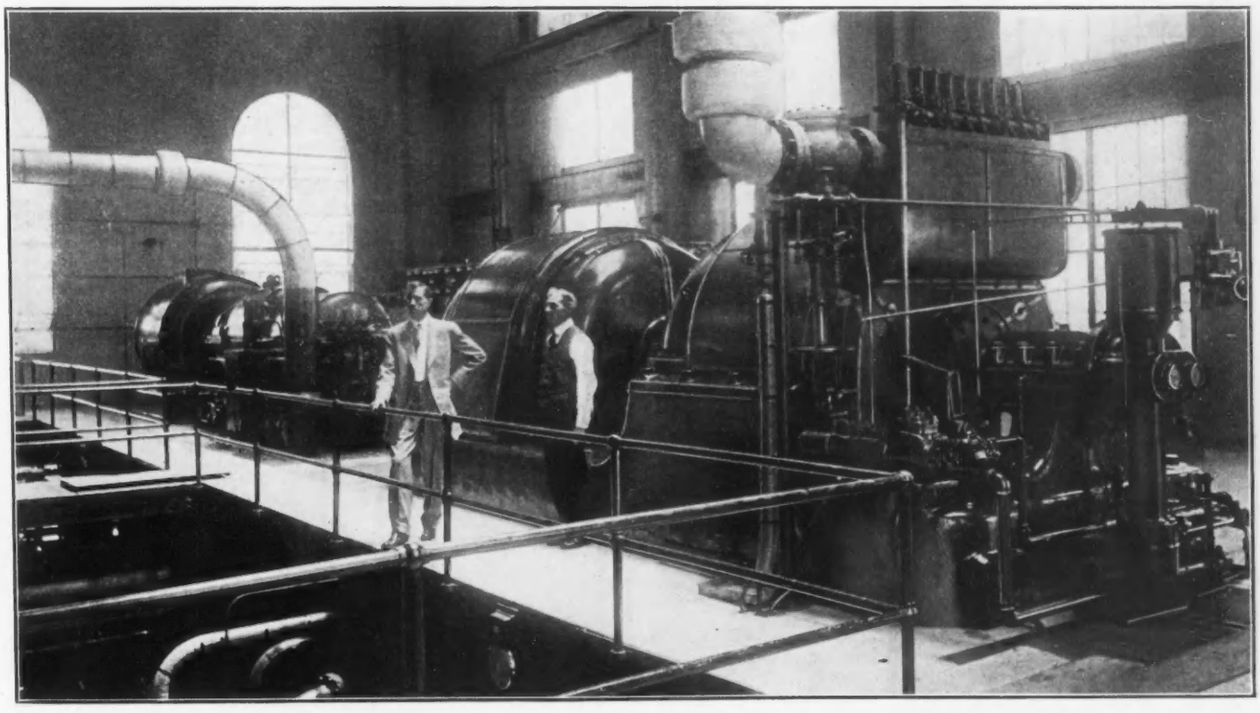


FIG. 1—TURBO-GENERATORS IN NEWARK (OHIO) STATION, OHIO LIGHT AND POWER COMPANY

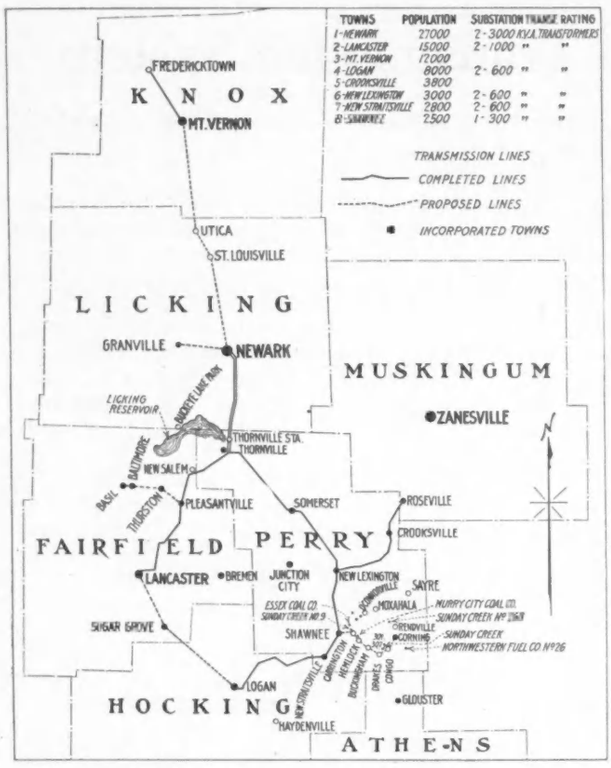


FIG. 3—TRANSMISSION SYSTEM OF OHIO LIGHT & POWER COMPANY

quent heavy draft allows a heavy bed of ash to be economically carried on the grates.

The boiler-room equipment at present consists of four 500-hp. hand-fired Babcock & Wilcox units which have been arranged for the future installation of coal bunkers and stokers. The boilers produce steam at 200-lb. pressure with 100 deg. Fahr. superheat. In the units last installed duplicate feed-water piping connections have been made at both the front and rear of the boiler drums. The piping at the rear of the settings is used only in emergencies.

The only feed water available at the plant carries a large percentage of magnesia which, if allowed to get into the make-up water, makes frequent cleaning of the boilers necessary. For this reason exhaust steam from the main units and from all of the steam-driven auxiliaries is collected in a Webster vacuum-type feed-water heater. Arrangements have been made through special piping for this heater to exhaust automatically into the condenser of one of the main turbine units if the pressure in it exceeds 5 lb. Thus no steam escapes from the system. By this arrangement it has been possible to keep the amount of make-up water required as low as 2 per cent. A close watch is kept on the boiler-room conditions with a view to securing the best possible operating economy. In the chief engineer's office a pyrometer has been installed and so connected that the temperature in the breeching of any boiler can be read at will. In the same office is installed apparatus for making continuous analyses of flue gases.

The steam and water piping in the station is covered and painted in symbolic colors. The live-steam lines are cream colored, the exhaust-steam lines are buff and the cold-water lines are brown.

Two horizontal turbines—a 1500-kw. Allis-Chalmers and a 2500-kw. General Electric—comprise the prime-mover equipment at present. Both exhaust into Alberger condensers. The company is, however, making preparations to double the station's generator rating by installing a modern switchboard. The present three-phase turbo-generators operate at 4000 volts, 60 cycles, and hence are able to supply the four circuits of the local distribution system at the desired potential without transformation. Energy for the transmission system taken from these units is stepped up to 66,000 volts in an outdoor substation just outside the plant. The transformers used will carry 1500 kva. if air cooled and 3000 kva. if water cooled.

TRANSMISSION-LINE CONSTRUCTION

For raising A-frame towers, square-base towers, 50-ft. and 60-ft. chestnut poles and for loading and unloading poles and loading A-frame towers on wagons during line construction a specially-built gin wagon was used. This wagon is shown in Fig. 6 and was made

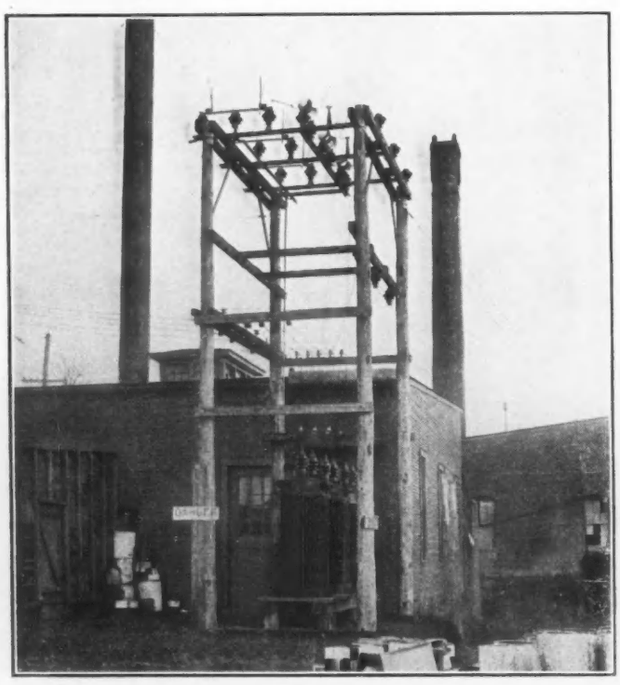


FIG. 2—SUBSTATION AT A CROOKSVILLE POTTERY PLANT

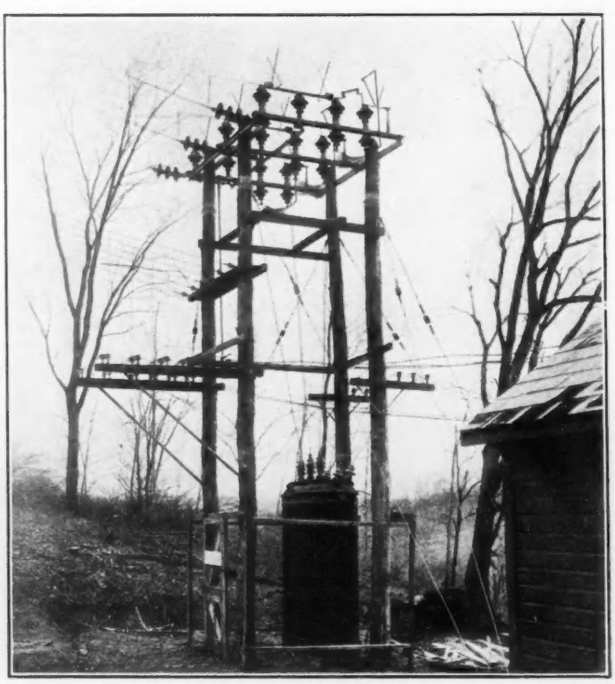


FIG. 4—SUBSTATION AT ZANESVILLE COAL COMPANY'S MINE

at a cost of $108. The trucks, which were those of an old hay bailer, cost $15; the blacksmith's bill was $66 and the remainder went for 6-in. by 8-in. main timbers and the 25-ft. pole. In hilly country such as was encountered the wide tread of the rear wheels proved a decided advantage, many times preventing the wagon from overturning. The arrangement of the main timbers permitted the front wheels to swing under the wagon which assisted in making short turns. The gin pole itself was underhung so that poles and towers could be raised without guy ropes. In the country traversed the fields were small and many fences were encountered, but nevertheless with this wagon the crew was able to erect as many as fifteen A-frame towers a day in winter weather.

The present transmission system includes 45.5 miles of steel tower lines and 34 miles of wooden pole lines. For the tower lines the maximum span length between Newark and Lancaster is 736 ft. and the average distance between towers is 312 ft. On the Thorneville-New Lexington line the maximum span length is 635 ft. and the average is 346 ft. Since the country through which these lines pass is very irregular the problem of placing poles and towers was important and often difficult to solve. In laying out the lines, right-of-way maps and complete field notes were made by a corps of civil engineers. Then with the aid of a celluloid strip on which a set of sag curves had been drawn to the same scale as the right-of-way maps the location of towers was indicated on these maps. The sag curves on the celluloid strip enabled the engineer making the locations to determine where to set towers so that the minimum clearance would be maintained. This method also proved useful in grading the line.

PORTABLE CAMP ARRANGEMENTS FOR BUILDING TRANSMISSION LINES

For building the cross-country transmission lines a fully-equipped construction crew was organized and provided with a portable cookhouse, a permanent cook and a definite plan for handling a commissary department. During the construction of the Newark-Lancaster line, as an example, the maximum number of men employed at any time was sixty-eight and the average number was forty-four. These men were divided into seven crews each having separate duties, namely, working excavations, setting foundations, assembling A-frame towers ready to raise, raising the A-frames, putting in concrete foundations, raising square-base towers and stringing the wire. The crew's camp equipment consisted of a cook wagon, a dining tent, a sleeping tent and a stable tent.

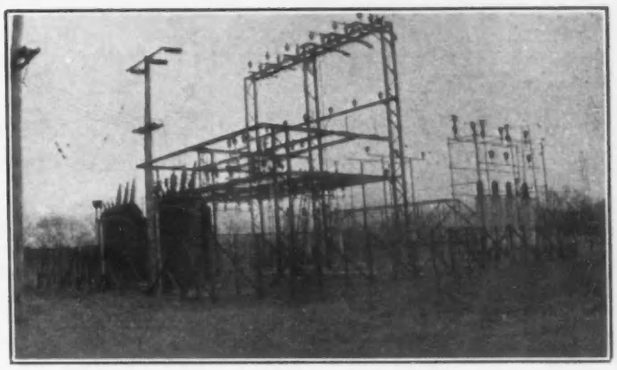


FIG. 5—OUTDOOR SUBSTATION AT NEWARK STATION, STEPPING VOLTAGE UP TO 66,000 FOR TRANSMISSION

The superintendent of construction, who was elected steward by the men, managed the commissary. At his order the company's paymaster held enough out of each man's pay check to settle for his portion of the bill. On the whole the plan was considered very satisfactory. The meals cost the men from 12 cents to 18 cents each. There were few disputes and no complaints from the merchants and farmers along the line. The value of the cook wagon and camp plan as stated by H. J. Buell, the company's chief engineer, may be summed up in the following statements: First, it relieved the company of the responsibility of finding room and board for the men in a sparsely settled territory; second, it eliminated the necessity of the company guaranteeing the payment of room and board bill; third, it enabled the men to save time in getting to and from work; fourth, it reduced transportation charges, and fifth, it proved to be a genuine money saver for the men and the company. That the whole plan was inexpensive may be judged from the fact that it required a total investment of but $300.

The officers and department heads of the company are: H. L. Montgomery, general manager; H. J. Buell, chief engineer; Fred C. Morrison, commercial manager; E. T. Wagenhals, superintendent at Newark; E. S. Browne, office manager at Newark; W. S. Smith, superintendent of construction; A. J. Darvah, Edward Matt, L. C. Laube, John Farbeaun and C. W. Runk, local managers at Mount Vernon, Lancaster, Logan, New Lexington and Crooksville.

Recently Mr. Montgomery has been transferred to Atlantic City, N. J., and Frank Espy, formerly of Tiffin, Ohio, has been made general manager of all of the American Gas & Electric Company's Ohio properties.

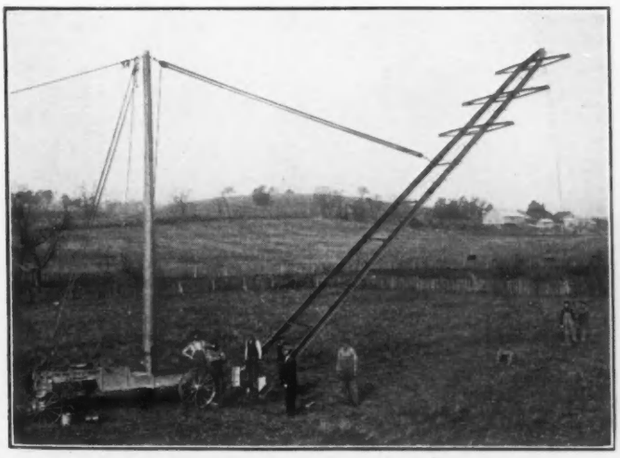


FIG. 6—USE OF HOME-MADE GIN WAGON FOR RAISING A-FRAME TOWERS

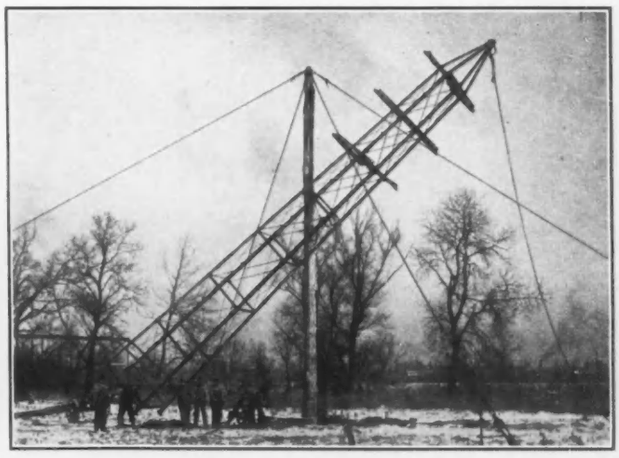


FIG. 7—METHOD USED TO RAISE HEAVY TRANSMISSION LINE TOWERS

Lighting Industry Started New Year Well

January Earnings Approximated $40,000,000, an Increase of $4,500,000—Output Approximated 2,000,000,000 Kw.-Hr., an Increase Over Previous January of 325,000,000 Kw.-Hr.

THE results of the operation of the light and power industry of the United States for the opening month of 1916, according to the returns received by the ELECTRICAL WORLD, besides showing the industry at the peak of its earning power up to the present time, indicate it to be in a decidedly stronger position also. The earnings presented in Table I were greater in January, 1916, than in January, 1915, by 13.3 per cent, while the January, 1915, earnings were larger than those of January, 1914, by but 4.1 per cent. The output for the first month of this year as compared with the first month of last year was greater by 22 per cent, while the output of January, 1915, as compared with that of January, 1914, was greater by but 1.4 per cent.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE-MONTH PERIOD

	Percentage of Industry Represented	Income from the Sale of Energy			Kw.-Hr. Output		
		1915	1914	Per Cent Increase	1915	1914	Per Cent Increase
Feb.	63	19,395,518	19,023,107	2.0	853,817,221	835,288,039	2.2
Mar.	64	18,654,443	17,529,054	6.4	939,117,179	896,903,968	4.8
April	65	18,406,412	17,675,784	4.2	900,536,022	859,235,144	4.8
May	65	17,644,205	16,764,546	5.3	920,895,324	842,386,583	9.3
June	65	17,603,614	16,476,255	6.9	925,067,308	836,292,076	10.6
July	64	18,488,793	17,200,827	7.5	971,699,054	880,768,487	10.4
Aug.	64	17,342,796	16,024,893	8.2	951,752,053	853,381,696	11.3
Sept.	65	18,547,170	17,074,927	8.6	1,003,606,094	871,573,412	15.1
Oct.	65	20,112,813	18,329,490	9.8	1,087,786,658	949,288,459	14.7
Nov.	65	21,899,048	19,720,232	11.6	1,150,669,073	948,704,941	21.3
Dec.	64	23,281,189	20,843,881	11.8	1,223,092,909	997,973,681	22.7
		1916	1915		1916	1915	
Jan.	64	25,080,138	22,170,279	13.3	1,190,246,059	975,261,607	22.0

On the basis of these figures it has been estimated that the gross earnings of the entire light and power industry for January, 1916, was $39,200,000, as compared with $34,700,000 for January, 1915. An estimate for output indicates for January, 1916, a total of 1,850,000,000 kw.-hr. as against 1,525,000,000 kw.-hr. for January, 1915, a gain of 325,000,000 kw.-hr.

The increase of $4,500,000 of gross earnings was contributed by the various sections of the country as follows: New England States, $590,000; Atlantic States, $1,550,000; Central States, $1,950,000; Pacific and Mountain States, $410,000. The percentage increases in earnings of January, 1916, over January, 1915, however, were as follows for the various sections: New England States, 15.1 per cent; Atlantic States, 12.0 per cent; Central States, 16.6 per cent, and Pacific and Mountain States, 9.5 per cent.

TABLE III—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT HOUR OUTPUT FOR UNITED STATES—CITIES GROUPED BY SIZE

	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
INCOME:										
Group 1	3.8	4.8	6.5	5.3	7.2	7.3	8.7	9.8	10.2	10.7
Group 2	5.0	6.2	2.8	8.8	9.1	10.0	11.4	12.8	13.7	21.6
Group 3	5.5	5.8	10.1	9.7	14.5	15.4	23.4	18.0	20.0	18.1
Group 4	3.9	7.1	6.9	8.2	8.0	9.0	8.7	11.9	13.6	10.4
Group 5	1.9	5.5	4.7	8.5	7.5	11.9	5.7	13.0	13.0	7.2
OUTPUT:										
Group 1	5.4	7.2	10.1	11.1	9.7	12.2	10.7	17.0	19.0	19.0
Group 2	11.2	13.1	9.1	18.1	19.0	18.9	21.4	29.0	31.7	27.8
Group 3	1.2*	6.1	11.2	4.5	13.0	24.0	27.3	36.0	33.0	33.6
Group 4	3.0	29.1	6.0	12.5	10.9	11.3	13.4	18.0	16.3	19.0
Group 5	5.9	15.5	14.8	20.5	12.7	19.3	1.7	13.4	9.7	8.5

*Decrease

The increase in output of 325,000,000 kw.-hr. was contributed as follows: New England States, 30,500,-

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Percentage of Industry Represented	New England States		Per Cent Increase	Percentage of Industry Represented	Atlantic States		Per Cent Increase	Percentage of Industry Represented	Central States (Illinois Excluded)		Per Cent Increase	Percentage of Industry Represented	Pacific and Mountain States		Per Cent Increase
			1915	1914			1915	1914			1915	1914			1915	1914	
INCOME	February	67	$2,246,794	$2,134,341	5.4	69	$8,037,878	$7,968,625	0.9	55	$5,296,786	$5,148,439	3.0	85	$3,576,432	$3,534,864	1.2
	March	67	2,146,032	1,999,326	7.5	69	7,777,126	7,419,808	5.2	55	4,885,384	4,465,728	9.5	88	3,605,893	3,412,842	5.8
	April	67	2,109,767	1,976,473	6.8	69	7,510,810	7,241,164	3.9	57	5,003,673	4,773,949	4.8	88	3,475,740	3,366,830	3.2
	May	67	2,035,680	1,887,606	7.9	69	7,100,334	6,912,581	2.6	57	4,946,907	4,577,818	8.1	88	3,383,749	3,233,989	4.8
	June	67	2,063,423	1,874,575	10.2	69	6,945,986	6,628,523	4.8	57	4,993,410	4,492,411	11.2	88	3,409,738	3,281,696	3.9
	July	66	2,020;513	1,835,968	10.2	68	6,710,217	6,519,442	2.9	56	4,801,699	4,211,641	13.9	88	3,539,168	3,317,713	6.8
	August	63	2,057,635	1,855,140	11.0	68	6,853,118	6,511,307	5.3	56	4,749,082	4,231.322	12.2	88	3,545,454	3,288,729	7.8
	September	66	2,162,064	1,949,663	11.0	68	7,288,842	6,904,245	5.5	57	5,285,358	4,691,751	12.6	88	3,664,215	3,387,717	8.2
	October	66	2,327,214	2,073,059	12.3	68	8,096,982	7,550,808	7.2	57	5,820,653	5,153,314	13.0	88	3,798,012	3,477,051	9.3
	November	66	2,472,539	2,188,049	13.0	67	8,894,805	8,158,589	9.0	57	6,342,582	5,554,226	14.2	88	4,069,995	3,703,124	10.0
	December	66	2,817,557	2,448,813	15.0	67	9,335,396	8,529,866	9.4	57	6,846,324	5,944,966	15.2	88	4,150,045	3,773,810	10.0
			1916	1915			1916	1915			1916	1915			1916	1915	
	January	65	2,765,048	2,381,765	15.1	67	9,581,748	8,557,406	12.0	57	7,701,543	6,603,336	16.6	88	4,170,899	3,812,671	9.5
KW.-HR. OUTPUT	February	67	66,600,132	61,515,979	8.3	69	312,443,505	305,307,260	2.4	55	238,938,034	232,520,476	2.7	85	229,865,568	229,185,967	0.3
	March	67	72,121,319	65,343,335	10.5	69	346,341,496	335,506,429	3.3	55	257,136,231	235,656,647	9.2	88	255,529,704	253,423,951	1.0
	April	67	68,475,232	62,442,110	9.7	69	320,142,323	311,476,008	3.0	57	257,967,434	237,673,326	8.5	88	246,287,781	239,661,364	2.8
	May	67	68,823,914	61,060,621	12.9	69	326,191,569	301,440,779	8.1	57	262,885,043	236,154,464	11.2	88	254,586,394	236,082,868	7.8
	June	67	71,566,127	60,972,379	17.4	69	318,245,370	293,751,083	8.5	57	265,930,311	234,286,440	13.2	88	261,083,835	237,843,021	9.8
	July	66	71,025,184	60,755,381	17.0	68	320,371,761	293,909,832	9.0	56	264,498,989	232,541,585	13.9	88	274,488,334	258,475,004	6.3
	August	63	71,954,506	60,870,433	18.5	68	329,947,721	302,960,234	8.9	56	272,508,518	240,423,753	13.4	88	276,631,551	248,463,980	11.3
	September	66	74,835,203	63,716,224	17.3	68	358,765,971	319,549,780	12.3	57	286,893,057	247,046,941	16.1	88	279,133,989	237,795,633	17.5
	October	66	82,568,951	69,882,867	18.3	68	400,516,741	353,685,472	13.3	57	305,962,017	268,972,416	13.7	88	292,885,623	251,095,356	16.8
			1915	1914			1915	1914			1915	1914			1915	1914	
	November	66	87,193,883	69,359,620	25.8	67	420,584,253	355,151,259	18.5	57	333,528,905	269,870,536	23.7	88	301,772,412	248,913,893	21.0
	December	66	99,744,195	80,446,521	24.1	67	447,158,465	373,213,316	20.0	57	356,296,949	287,131,989	24.1	88	311,034,100	249,996,678	24.5
			1916	1915			1916	1915			1916	1915			1916	1915	
	January	65	94,148,174	74,477,605	26.5	67	430,949,170	356,582,726	20.9	57	355,110,790	278,466,695	27.5	88	301,405,948	258,758,084	16.5

TABLE IV—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR NEW ENGLAND STATES—CITIES GROUPED ACCORDING TO SIZE

	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
INCOME:										
Group 1	6.3	9.4	11.6	11.2	11.0	10.6	12.7	13.8	14.8	16.5
Group 2	4.04	7.5	7.0	7.0	9.6	10.3	12.6	12.7	16.1	15.4
Group 3	20.6	8.9	21.8	10.2	16.5	14.7	17.3	15.5	22.8	22.1
Group 4	8.4	7.1	11.9	6.6	9.2	10.0	8.8	9.0	9.6	12.1
Group 5	0.4*	1.0*	2.8	16.0	21.2	5.8	8.3	13.7	23.5	20.6
OUTPUT:										
Group 1	12.7	16.0	19.0	17.2	17.2	19.2	20.8	28.7	26.2	29.0
Group 2	12.3	19.9	20.8	26.0	26.0	21.7	18.3	30.0	26.5	26.0
Group 3	3.2	7.0	17.9	13.5	12.3	14.4	8.7	23.0	22.5	39.5
Group 4	12.1	6.3	17.1	7.8	13.6	9.0	20.6	20.1	18.5	15.1
Group 5	25.5*	13.5*	1.0	11.0	15.1	8.5	1.8	51.0	14.5	22.6

*Decrease

000; Atlantic States, 111,500,000; Central States, 135,000,000, and Pacific and Mountain States, 48,000,000. The percentages of increase in output for January of this year, compared with January of last year by sections, were as follows: New England States, 26.5; Atlantic States, 19.8; Central States, 27.5, and Pacific and Mountain States, 16.5.

Contrary to the conditions of a year ago, 1916 opened up with the nation's industrial activity in excellent shape. This growth, of course, was not spontaneous, but had been gradually increasing for some months. In the New England States, which region was the first to feel the industrial boom in this country, prosperity was evident in almost every line. The generating companies of New England have shared in this prosperity to a large extent. Many companies have found it necessary

TABLE V—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR ATLANTIC STATES—CITIES GROUPED BY SIZE

	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
INCOME:										
Group 1	1.6	2.0	3.8	1.4	4.0	4.4	6.2	7.6	8.3	11.1
Group 2	5.6	8.2	8.0	9.7	11.6	11.0	11.9	15.0	14.0	18.2
Group 3	4.1	1.6	7.5	7.5	8.5	8.9	11.0	10.0	13.1	11.9
Group 4	2.9	6.2	3.9	7.0	8.4	10.0	9.8	14.4	15.3	17.6
Group 5	15.2	19.6	14.8	†	2.0*	14.3	10.9	14.6	12.2	16.0
OUTPUT:										
Group 1	4.8	9.0	8.2	8.0	9.0	11.6	12.1	16.0	20.1	21.1
Group 2	7.6	7.1	11.0	17.0	15.0	16.3	16.8	26.6	25.5	26.4
Group 3	4.1*	3.2	7.2	7.5	6.4	10.4	15.8	22.1	16.6	20.1
Group 4	1.9	22.5	7.1	13.8	13.2	12.5	14.8	22.0	18.9	15.8
Group 5	57.2	71.5	61.8	†	11.4	13.8	2.8*	18.6	20.6	1.5

*Decrease. †Results omitted owing to insufficient returns.

to make extensions that eighteen months ago would have been unthought of. One company, in particular, located in a rather prosperous mill center, received during this boom, contracts for a load more than twice as great as the existing load.

The Atlantic States, which were rather slow to respond to the call for manufactured products, were fully alive to the situation in January, so far as these figures show. Building picked up and manufacturers who formerly were timorous were then working their shops to capacity. The South had apparently recovered from the shock of the war and was enjoying a share of in-

TABLE VI—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR CENTRAL STATES—CITIES GROUPED BY SIZE

	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
INCOME:										
Group 1	7.3	9.8	11.4	11.8	12.2	12.4	12.3	17.0	15.8	14.3
Group 2	3.5	3.0	5.6	7.0	7.5	8.6	10.2	10.8	11.0	26.0
Group 3	10.4	15.5	19.6	16.4	21.0	22.0	22.7	24.0	26.0	25.3
Group 4	6.0	6.7	12.4	13.0	16.9	17.9	16.0	19.8	18.3	9.6
Group 5	7.6	19.9	5.0	1.2	20.2	13.5	24.7	9.6	18.0	5.7
OUTPUT:										
Group 1	6.8	8.4	10.8	11.8	12.2	15.2	10.4	22.0	21.9	24.9
Group 2	12.5	9.7	13.5	11.1	9.8	9.0	14.0	21.5	26.4	29.0
Group 3	13.1	27.0	26.1	28.9	31.0	29.3	34.2	43.0	43.0	35.3
Group 4	7.9	10.0	15.7	18.2	26.1	29.0	33.5	36.7	18.5	53.4
Group 5	39.7	28.8	20.4	24.9	25.1	48.0	3.0	17.3	20.6	13.3

TABLE VII—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR PACIFIC AND MOUNTAIN STATES—CITIES GROUPED ACCORDING TO SIZE

	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
INCOME:										
Group 1	4.0	3.1	9.0	5.1	7.0	13.9	7.5	7.5	6.0	11.6
Group 2	9.4	12.7	11.1	13.0	11.1	11.5	14.3	15.7	17.3	†
Group 3	0.3*	3.4	3.6	7.9	17.1	19.7	21.4	20.0	24.6	19.7
Group 4	3.8*	8.7	1.6*	7.8	0.2	0.3	0.1	4.3	10.8	2.7
Group 5	2.7*	2.4*	3.3	4.5	1.7*	15.0	3.1	13.5	3.9	10.5
OUTPUT:										
Group 1	4.5	2.3	10.8	6.2	6.3	8.4	7.1	9.9	13.1	9.1
Group 2	11.6	19.0	14.9	27.5	39.3	40.3	41.3	51.0	56.0	†
Group 3	3.5*	3.8	12.4	8.4*	18.5	49.2	52.4	67.0	67.0	56.0
Group 4	4.7*	87.0	4.5*	11.8	0.2	4.1	1.5	6.2	10.5	1.7
Group 5	9.6	18.5	3.6	10.9	8.0	21.0	3.5	8.3	1.0	1.0

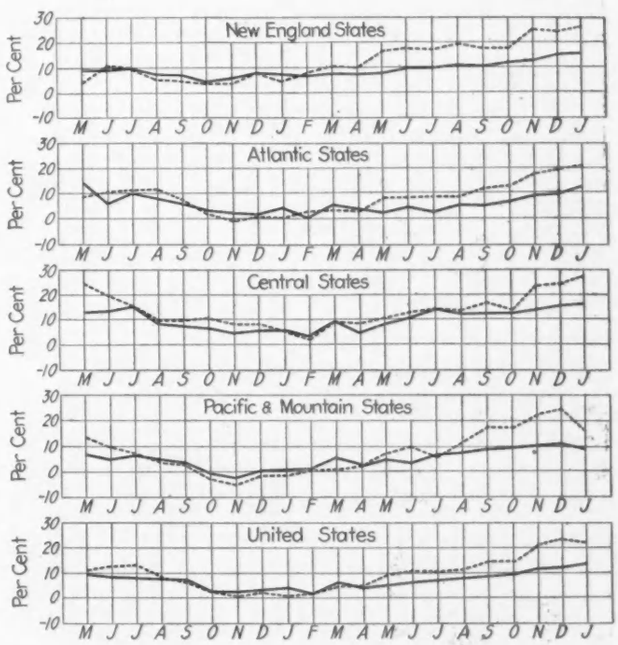
*Decrease. †Results omitted owing to insufficient returns.

dustrial prosperity. The iron and steel business, as has been heralded from one part of the world to the other, absolutely reached the limit of its output. It could do no more, no matter what its orders were.

Similar conditions were reported from the Middle West. This territory, as these reports show, had outstripped the New England section both in the increase in earnings and in the increase in output. Higher prices for electrical products apparently did not deter the industries of the Middle West from seeking the advantages of electric drive.

In the far West the January results, while showing a considerable increase over the results for January, 1915, did not show as great a percentage of increase by many per cent as the increases shown in previous months.

Figs. 1 to 5 show graphically the percentage increases which are contained in Tables I and II. The remaining tables show the percentage increase both in earnings and output for companies grouped according to the size of the communities which they serve. Group 1 represents the average records of companies serving communities of which the population is greater than 100,000 inhabitants. Group 2 is for those companies serving communities having a population between 50,000 and 100,000 inhabitants; group 3, between 25,000 and 50,000 inhabitants; group 4, between 10,000 and 25,000 inhabitants, and group 5, between 5000 and 10,000 inhabitants.



FIGS. 1 TO 5—PERCENTAGE INCREASES OF EARNINGS AND OUTPUTS OF COMPANIES GROUPED BY GEOGRAPHIC SECTIONS

Service Requirements of the Electric Arc Furnace

Characteristics of the Furnace Load—Effect of Operation on System Regulation—Amount of Reactance Necessary to Limit Short-Circuit Currents to Rating of Station Generators

By Harry Hollis

Electrical Engineer, Edison Electric Illuminating Company, Lebanon, Pa.

ONE of the modern developments in the steel business is the manufacture of so-called "electric steel" by means of the electric furnace. The adoption of this process by steel mills has opened up a comparatively undeveloped field of new business for the central station. The Edison Electric Illuminating Company of Lebanon, Pa., in November, 1914, secured a contract to supply energy to a three-phase, 60-cycle, Heroult 1-ton furnace, which has been in successful operation for the past twelve months. The furnace was installed by the manufacturers at the plant of the Lebanon (Pa.) Steel Foundry.

The mechanical operation of this furnace is taken care of by a small motor-generator set supplying direct current to three motors controlling electrode feed and a small motor driving the "Thury" regulator. A three-phase motor of the slip-ring type is used to tilt furnace in pouring a heat. The motor-generator set and all transformers are located in a fireproof compartment so that the furnace operators do not come in contact with any high potential. The transformer room is kept locked and a suitable danger sign is located on the door of this room.

The energy is generated by the central station at a pressure of 2400 volts, three-phase, 60 cycles, and the furnace load is taken from the same busbars that supply a mixed load used for lighting, industrial power and street railway. The railway load is carried by a 500-kw. rotary converter. The generating units include one 1250-kw. and one 500-kw. turbo-generator. The average demand during the winter months, between the hours of 7 a. m. and 11 p. m., is about 1000 kw. at 80 per cent power factor, the 1250-kw. set carrying the load except over the lighting peak, when the 500-kw. unit is operated.

Primary Feeder and Transformers

The 2400-volt feeder consists of three No. 0000 wires mounted on a wooden crossarm with a mean distance between wires of 24 in. The length of line is 1.08 miles. The feeder panel at the generating plant is equipped with an oil switch with an overload trip, operated through an inverse-time-limit relay set for 200 amp. (800 kva. at normal potential), and trips in eight seconds at this setting.

The receiver panel at the foundry end is located in the transformer room, and is equipped with three single-pole, disconnecting switches. The instruments consist of a polyphase, graphic, power-factor indicator and a polyphase, recording, watt-hour meter. The energy is measured and sold as primary power. From the receiver panel the primary wires pass through an oil switch operated from the furnace-control panel. The switch has an overload trip operated through an inverse-time-limit relay set to operate with 91 amp. in six seconds; that is, with 362 kw. at normal potential, the furnace being rated at 225 kva. at 92 per cent power factor. The three single-phase transformers are rated

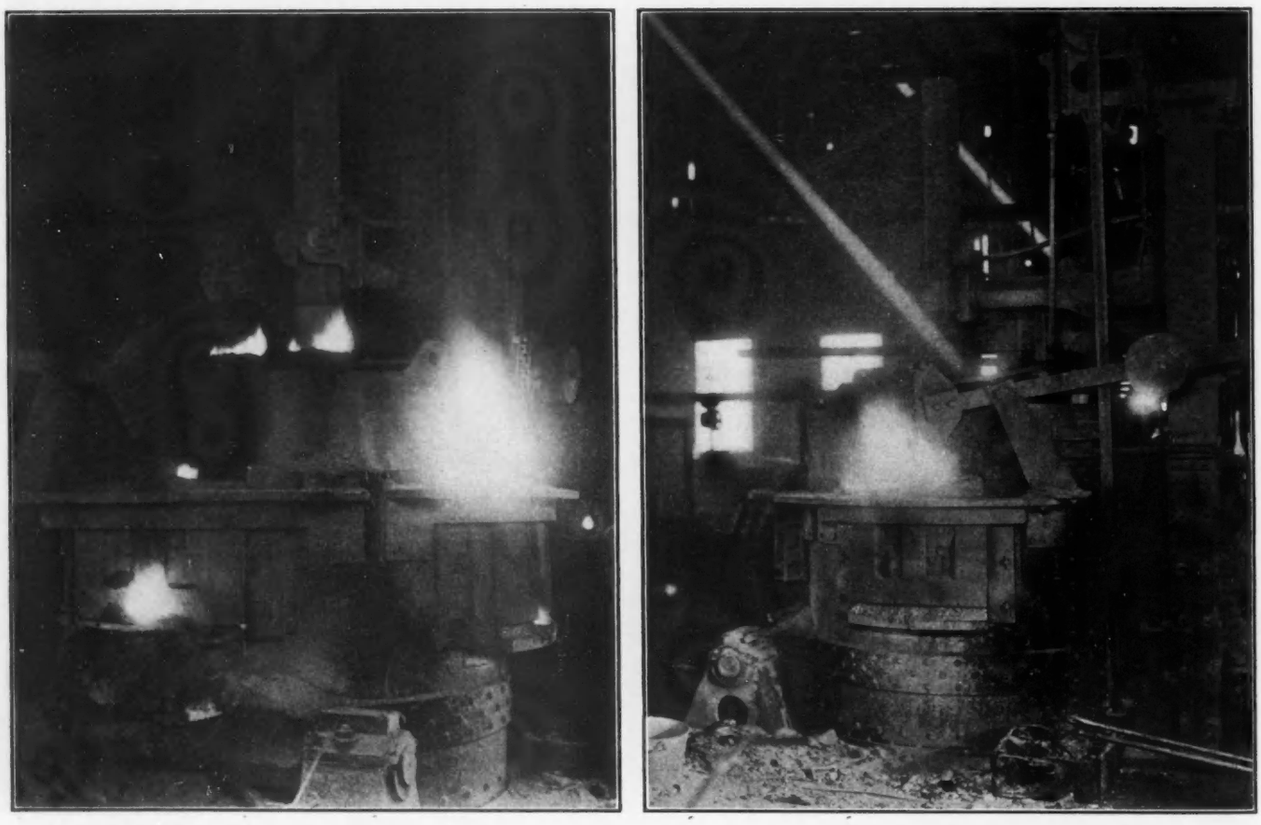


FIG. 1—A 1-TON, THREE-PHASE ELECTRIC-ARC FURNACE OPERATED AT THE LEBANON (PA.) STEEL FOUNDRY

at 75 kva. each, with primary wound for 1330Δ — 2300Y volts and the secondary for 90 — 110 volts. The primaries are Y-connected to the primary mains. The secondaries are connected delta and, as operated, give 110 volts. The three electrodes of the furnace are connected to the 110-volt secondaries by means of two 500,000-circ. mil cables in parallel.

CHARACTERISTICS OF FURNACE LOAD

The character of the furnace load is that of a three-phase electric arc without a steadying resistance or reactance in series with the same. The furnace when starting a heat picks the arc without making a short-circuit by having coke placed on the scrap metal directly under each electrode. After the three arcs are started the first thirty to forty minutes are generally free from short-circuits. At the end of that time the electrodes have melted holes in the scrap metal a little larger than themselves, and into these the electrodes feed. The iron therefore begins to fall in along the sides of the holes into which the electrode extends, causing short-circuits which operate an automatic oil switch on the control panel. If the operator immediately raises the three electrodes and places coke into these holes the furnace can be started again, but if this is not done the breaker is liable to trip out as often as the operator puts it in. Other short-circuits are caused after the greater part of the charge is in a molten state by the operator pushing into the bath solid pieces of the unmelted metal laying along the sides of the furnace. After the charge is all melted, the slag formed on the molten metal by lime tends to prevent short-circuit. The load varies continually during the heat, due to change of resistance of the arc, these variations averaging 30 per cent above and below normal load. Short-circuits sufficient to operate the breaker five or six times each heat of three and one-half hours occur, and must be considered as characteristic of the electric-arc furnace melting cold scrap. These must be limited to the capacity of the generating system.

The effect of a short-circuit on the regulation, both as to frequency and voltage, of an electric-generating system depends on the magnitude and time element of short-circuits and the regulating characteristics of prime movers. The speed regulation of the prime movers is of considerable importance, and especially so when equipped with direct-connected exciters, as any sudden change of speed, due to heavy loads being thrown on and off, gives the automatic voltage regulator double duty.

LIMITING SHORT-CIRCUIT CURRENTS TO CAPACITY OF GENERATING SYSTEM

A practical method to limit the short-circuit current to a value that will not cause disturbances in the generating system is secured by means of reactors. The practice of the writer's company in one case where it was found necessary to add additional reactance can be taken as an example of the requirements in this regard.

With a full load value of 75 amp. per phase at 2300 volts in the case mentioned, the resistance drop is 2.58 per cent and reactive drop 6.6 per cent, including line and transformers. The power factor of the short-circuit current depends on the ratio of the reactive to resistance drop.

$$\text{Tangent } \varphi = \frac{0.066}{0.0258} = 2.55 = 68^\circ\ 36'$$

$$\text{Cos } \varphi = \cos 68^\circ\ 36' = 0.364$$

A measure of the impedance which limits the short-circuit current expressed in per cent of operating voltage is then,

$$= \sqrt{0.0258^2 + 0.066^2}$$
$$= 0.0708$$

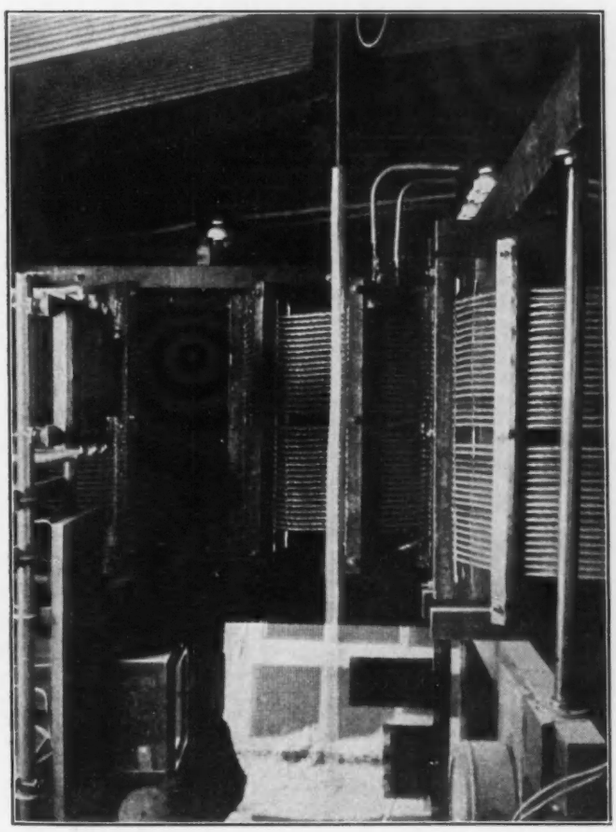


FIG. 2—THREE ARTIFICIAL REACTORS INSTALLED IN PRIMARY LEADS OF TRANSFORMERS SERVING STEEL FURNACE

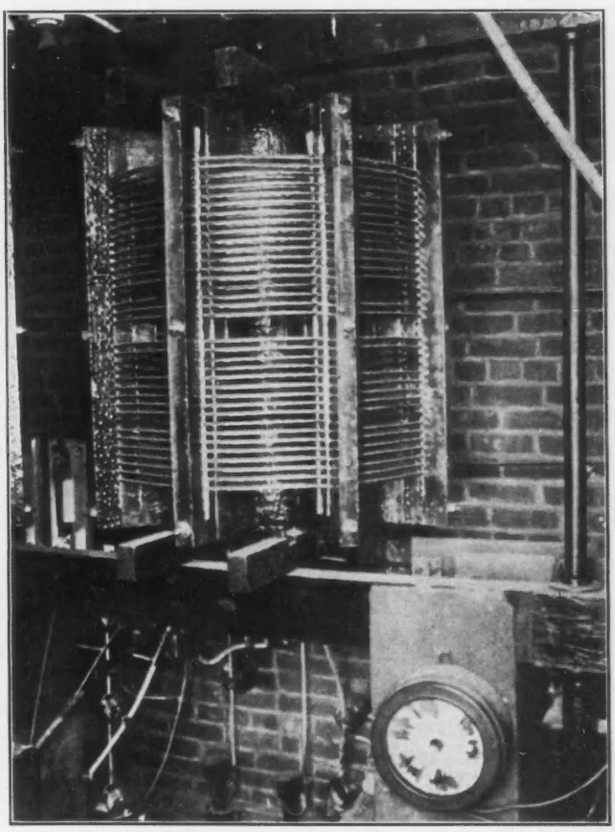


FIG. 3—MOUNTING AND CONSTRUCTION DETAILS OF ONE REACTOR INSTALLED ABOVE FLOOR OF TRANSFORMER ROOM

The short-circuit current, therefore, is,

$$\frac{1}{0.0708} = 14.1 \text{ times full-load current.}$$

With a normal load of 300 kw., the kilowatt value of short-circuit current is,

$$[0.364 \times (14.1 \times 300)\ ] = 1539 \text{ kw.}$$

Thus with a load on the generator of 1000 kw. a momentary load of 2539 kw. may exist when the furnace is shorted. Because of this possible fluctuation voltage regulation such as is demanded by the motor and lighting load can hardly be expected.

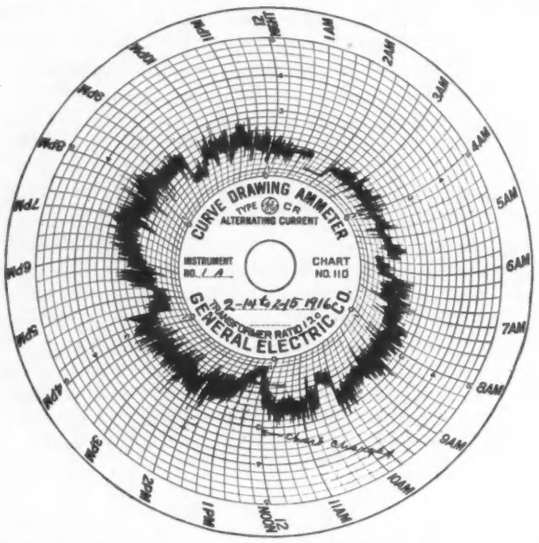


FIG. 4—CHARACTERISTIC CURVE FOR 1250-KW. GENERATOR CARRYING 1-TON FURNACE LOAD—AMPERES IN ONE PHASE

The steel furnace was off the circuit for charging scrap at 12.15 p. m.; 4.30 p. m.; 9.15 p. m., on the 14th and at 1.20 a. m.; 5.40 a. m., and 10.05 a. m., on the 15th. The instrument transformer ratio for the above record was 120 to 1.

Addition of Artificial Reactance

It was then decided to increase the reactance of the line by the addition of artificial reactance. These reactors were designed by the Edison Electric Illuminating Company and consist of three coils of seventy turns each of No. 0 seven-strand copper wire, with a mean diameter of coil of 30 in. The wire supports are resin-filled maple mounted by means of brass studs on cores made of a seasoned chestnut pole. The complete installation on the steel foundry premises cost $307.

The addition of these reactance coils in the primary leads of the transformers brought the resistance drop of the circuit to 2.9 per cent and the reactive drop to 11.68 per cent. The power factor then becomes,

$$\text{Tangent } \varphi = \frac{0.1168}{0.0294} = 3.96 = 75^\circ\ 48'$$

$$\text{Cos } \varphi = \cos 75^\circ\ 48' = 0.2453$$

The impedance in this case is shown to be,

$$= \sqrt{0.0294^2 + 0.1168^2}$$
$$= 0.1204$$

The short-circuit current is,

$$\frac{1}{0.1204} = 8.3 \text{ times full load value.}$$

The kilowatt value of the short-circuit current is,

$$0.2453 \times (8.3 \times 300) = 610.79 \text{ kw.}$$

The load on the generator during short-circuit is then,

$$1000 + 610.79 = 1610.79 \text{ kw.}$$

The automatic switch on the control panel was reset to trip out with a current value twice the normal operating demand and the inverse-time-limit set to operate as near instantaneously as possible. The quick action of the automatic overload tripping device is desirable to prevent the automatic voltage regulator on the generator building up an excessive field due to the load of the short-circuited feeder with a power factor of 0.2453, combining with normal load resulting in a load of 1610 kw. at a power factor of 0.47. With this high saturation of generator field when the automatic overload switch opens, the generator voltage overshoots normal voltage due to the regulation of the generator. Therefore, the overload trip should be set to trip out, if possible, before the automatic voltage regulator has time to operate in building up an excessive field.

Desirability of Electric-Furnace Load

The general conclusions are that the electric-arc furnace is a desirable business, giving a balanced three-phase load of high power factor and load factor, and can be successfully operated from a central station of moderate capacity. That the service has been satisfactory is attested by the fact that the Edison Electric Illuminating Company has recently closed a contract to supply current to an additional furnace of 2-ton capacity at the foundry which has operated the 1-ton furnace for the past twelve months.

In any case the short-circuit current of the furnace feeder should be limited to a definite value by means of reactance. On the new 2-ton installation transformers having a reactance drop of 10 per cent are specified by the company.

It is of great importance to the steel mill, as well as to the central station supplying energy to operate furnaces, that all electrical equipment of the furnace be inspected at definite intervals by a competent electrician-mechanic. The steel plant already referred to employs a capable engineer, who calls at the foundry every Saturday afternoon and spends about three or four hours going over the equipment. This is all the expert attention required during the twelve months' operation. W. G. Gardner of Lebanon, Pa., who is the plant inspector, constructed the reactance coils designed by the writer's company, and designed special electrode holders to stand severe operating conditions imposed on the apparatus. These will eliminate the necessity of replacing a new one each week, as was formerly required. Besides saving the price of these holders two extra heats per week are made possible, being formerly prevented on account of holder troubles. The holders designed by Mr. Gardner have been in use four months without giving trouble.

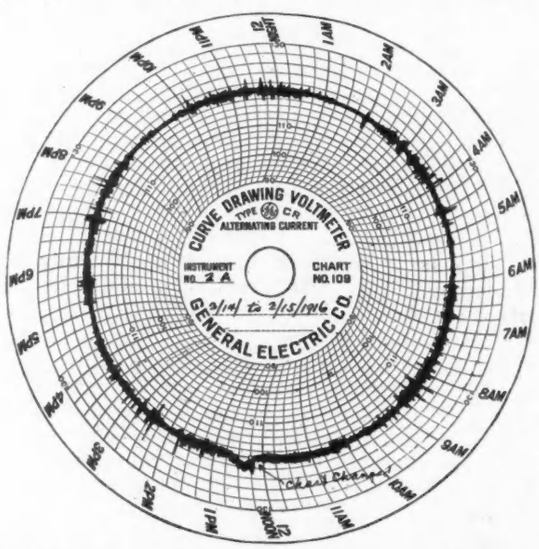


FIG. 5—VOLTAGE BETWEEN PHASE WIRES OF GENERATOR BUS FOR PERIOD COVERED BY CHART IN FIG. 4. INSTRUMENT TRANSFORMER RATIO FOR RECORD 20 TO 1

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Minimizing Electrolysis of Cable Sheaths

How the Edison Electric Illuminating Company of Brooklyn Has Ascertained Where Damage Is Liable to Result from Electrolysis and the Methods Used to Drain Stray Currents at These Points

While the amount of lead which will be corroded in the period of a year by a current leaving a cable sheath is usually not more than 5 per cent of the maximum theoretical value (74 lb. with 1 amp.), still it is important to prevent electrolysis since corroded spots may permit moisture to reach the insulation and thereby cause break-down. The surest way of avoiding trouble from this source is to prevent stray currents, but this is not always practicable. The next best step is to improve the return circuits of all grounded systems in the vicinity, minimize the opportunities for stray currents to reach cable sheaths, and provide high-conductivity paths for sheath currents where they tend to leave the cable. This method has been employed by the Edison Electric Illuminating Company of Brooklyn in co-operation with the electric railway companies operating in its territory.

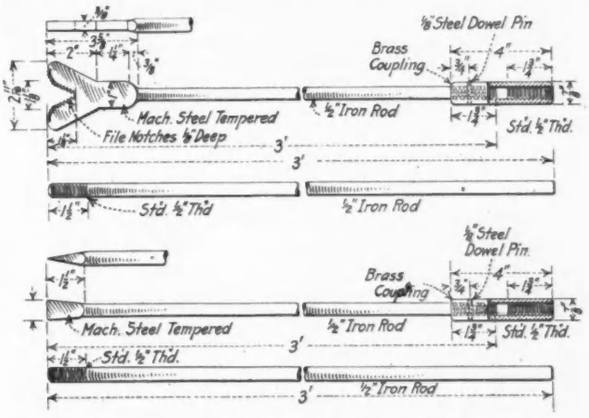


FIG. 1—TERMINALS USED IN MEASURING POTENTIAL DIFFERENCES

Each of the rods employed in securing contacts for potential-difference measurements was made in two joinable 3-ft. sections to facilitate handling. The forked rod was used to obtain contact with cable sheaths and the screwdriver point to obtain contact with other grounded conductors. To connect these contact rods with the testing instruments 15 ft. of reinforced lamp cord was soldered to the forked-rod coupling and 85 ft. to the pointed-rod coupling.

For the purpose of ascertaining where electrical drainage facilities were required, potential-difference measurements were taken within 1500 ft. of each railway substation between the electric-service company's cable sheaths and neighboring gas and water pipes, track-return circuits and the earth. Notations were made to indicate where the cables were electro-positive to other grounded conductors, since this is the condition under which cable sheaths are most seriously damaged by electrolysis. The readings thus obtained in the vicinity of each substation were plotted on cross-section paper to show at a glance the points between which existed the greatest differences of potential. At such points graphic voltmeters were connected for twenty-four hours to ascertain whether the potential difference changed excessively during that period. Temporary bonds of known cross-sectional area were connected between the cable manholes in which readings were taken, and the railway return circuits and the current drained off was computed from the millivolt drop in certain lengths by means of the accompanying table. The results of these tests were then indicated by different-colored dots and lines on a map showing the layout of cables and locations of substations. In this form the preliminary survey was submitted to the railway companies whose return circuits were causing most of the stray currents and permission was secured for drainage of the cable sheaths by connecting them with the negative railway busbars. The railway companies furnished all cable for this purpose, the electric-service company constructing the ducts between its own manholes and those of the railways. Each company installed the cable in its own ducts.

TABLE FOR DETERMINING CURRENT IN LEAD CABLE SHEATHS OR BARE COPPER FROM MILLIVOLT DROP ALONG A MEASURED LENGTH OF SAME

Lead Cable Sheaths		Bare Copper	
Size Cable	Amps. per Millivolt per 2 Ft.	Size Copper	Amps. per Millivolt per 2 Ft.
No. 00, three conductor	4.55	500,000 circ. mil	23.9
1,000,000 circ. mil	4.48	250,000 circ. mil	11.9
No. 00, four conductor	4.25	No. 0000	10.3
250,000 circ. mil, three conductor	4.15	No. 00	6.5
1,000,000 circ. mil, single	2.79	No. 0	4.1
500,000 circ. mil, single	2.29	No. 6	1.3
350,000 circ. mil, single	2.07		
No. 00, single	1.63		
No. 12, three conductor	0.97		
200,000 circ. mil, single	0.95		
150,000 circ. mil, single	0.88		
80,000 circ. mil, single	0.60		
41,000 circ. mil, single	0.53		

The first real work of minimizing electrolysis damage was done by bonding all cables in each manhole together with 0.0508-in. by 0.375-in. tinned copper rib-

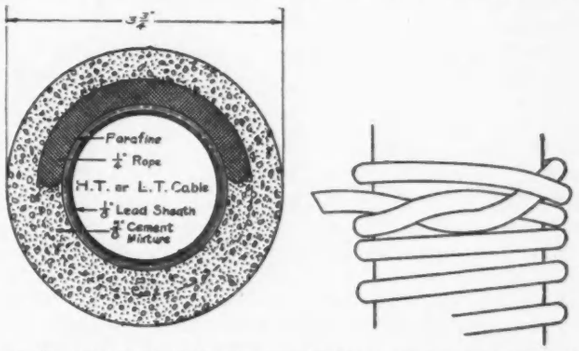


FIG. 2—CROSS-SECTION OF FIREPROOF CABLE COVERING AND METHOD OF ATTACHING ROPE BOND FOR CEMENT

Before the fireproof covering is applied the cable sheath is cleaned and coated with paraffin at 110 deg. C., then wrapped helically with overlapping strips of cheesecloth, and coated with a second layer of paraffin at 120 deg. C. Around this insulation is coiled with a 0.5-in. pitch a 0.25-in. hemp rope free from oil, tar and acids. This forms a bond for the fireproof covering, which consists of a 1:2 mixture of Portland cement and clean sharp sand.

bon, which is equivalent to No. 6 B. & S. gage wire. Drainage connections were made at first in suburban sections where the railway traffic is light. Fuses rated at twice the maximum current in the connections were installed in the Brooklyn Edison manholes in series with the drainage connections to prevent possible overloading of the cable sheaths in case of heavy short-circuits on the railway system. Graphic millivoltmeters were connected with each of the bonds and between the sheaths and earth, and the records were watched carefully before proceeding with the next case. It was found that the sheath currents on Saturdays and Sundays were appreciably different from those on weekdays. By calibrating different sizes of cables and measuring the millivolt drops in certain lengths the sheath currents on each side of drainage connections were determined and their sum was compared with the current in the bond and with total sheath current in the adjacent manhole. If the values did not agree it indicated that current was flowing on or leaking off between manholes. With the system of bonding and draining employed, however, not a single case of leakage between bonded points was noticed.

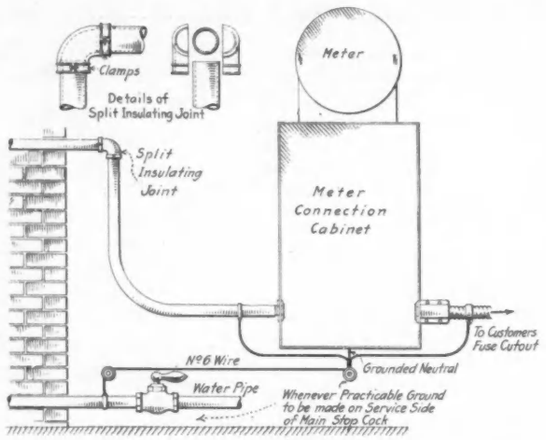


FIG. 3—METHOD OF INSULATING ENTERING CONDUIT OR CABLE SHEATH FROM GROUNDED HOUSE-SERVICE CONDUIT TO MINIMIZE COLLECTION OF STRAY CURRENTS

Just inside the building wall is a split insulating joint which electrically separates the electric-service company's conduit or cable sheath from the house-service conduit but permits grounding the latter according to Underwriters' rules.

To minimize the amount of current reaching the cable sheaths every attempt has been made to prevent moisture and dampness coming in contact with the cables. The ducts are pitched between manholes, the manholes and service boxes inspected and cleaned periodically, and the sheaths of large cables covered with fireproofing applied in such a way that it also prevents collection of stray currents. Concrete is used as the fireproofing material, but before it is applied two coats of paraffin separated by cheesecloth are applied to insulate the sheaths from the concrete. The method of covering the cables is shown in an accompanying drawing.

Since the drainage connections have been installed current and potential readings have been taken on every bond. If any changes are noted, a new survey is made of the entire system to ascertain what revisions are necessary. At present about 2080 amp. is drained from the cable sheaths on the average, the current sometimes falling as low as 1045 amp. and rising to 3450 amp. Occasionally a cable is now damaged by electrolysis, but the cases are becoming less frequent than formerly. It may be pointed out in connection with draining the cable sheaths that the Brooklyn Edison Company is inserting a fiber sleeve in every service pipe just inside the building wall as shown in the accompanying drawing. The sleeves consist of split sections that can be clamped over the ends of pipes, which must be joined.

Coal-Bunker Construction in Conners Creek Power Station at Detroit

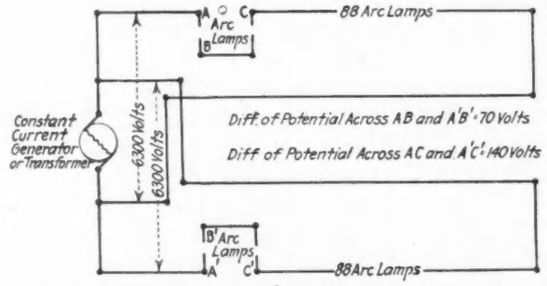
The large 500-ton coal bunkers over the 2300-hp. boilers in the plant of the Detroit Edison Company at Conners Creek are made of steel plates and are lined with smooth vitrified tile laid in bitumastic cement. The coal is run through a crusher and reduced to 1.75-in. pieces before it is taken to the hoppers, so that the danger of large lumps injuring the tile is largely eliminated. As an additional precaution, steel baffle plates have been installed at the top of the bunkers to intercept the coal as it falls from the conveyor buckets and slides it to the sloping sides of the bin. The coal therefore reaches its resting place in the bunkers largely by a sliding process instead of by falling. James N. Hatch, consulting engineer, in commenting on this installation before the Western Society of Engineers at Chicago, declared that in his opinion it was the best solution of the coal-bunker problem. Steel-plate bunkers, if unlined, will rust, and concrete bunkers are likely to pit and roughen.

Hazards of Working on Series Arc Lamps

BY H. B. SWEENY

General Inspector Lehigh Navigation Electric Company, Hauto, Pa.

Too many arc-lamp inspectors and trimmers working on constant-current systems fail to recognize the hazards of their duties because the potential across each lamp when operating normally is relatively low, usually about 70 volts. This pressure is not the only one that exists, however, as can be understood by studying the accompanying drawing. For instance, one of the bus-bars at the station may be purposely or accidentally grounded, in which case a potential of several thousand volts might exist on a circuit of ninety lamps between the ground and the terminals of a lamp near the bus-bar of opposite polarity. Fatal voltages might also exist between a lamp and ground if any portion of the series circuit were grounded, as frequently happens accidentally. Another source of danger is in accidentally shunting the body with any high-resistance medium in series with the circuit. This is very liable to occur in re-establishing service which has been interrupted by some high-resistance impurity lodging betwen electrodes or by the latter becoming separated. Under these conditions no arc lamps in series with the gap will be in operation; therefore full voltage will be impressed across any high-resistance substance like the body which may span the gap in the circuit. These cases serve to show the necessity of using well-tested rubber gloves



CONSTANT-CURRENT ARC LAMP CIRCUITS SHOWING VOLTAGES BETWEEN DIFFERENT POINTS

when working on series arc lamps and closing the lamp short-circuiting switch. As an additional precaution, lest flaws exist in the gloves, the following safety-first rules should also be observed: Do not have any part of the body grounded while working on a lamp, and do not have any part of the body in parallel with any part of the lamp which is in circuit.

Value of Preheating Boiler-Furnace Air Supply

The Use of Air from Preheater and the Warm Air from Large Turbo-Generators—Effect on Furnace Performance

BY R. I. ELKIN

It has often been suggested that the warm exhaust air from turbo-generators be led to the boiler room for use in the furnaces instead of being allowed to pass away unused. The intention is to utilize this air, which has already been warmed, instead of the comparatively cold air that could otherwise be drawn in from outside, to avoid cooling the fires and robbing them of heat. This practice is now being followed in large stations, notable examples being in the Northwest station of the Commonwealth Edison Company, Chicago, and the Conners Creek station of the Detroit Edison Company. In the former station there are at present installed two 20,000-kw. and one 30,000-kw. turbo-generator, and in the latter two 20,000-kw. units.

The advantage of preheating air, or at least utilizing air that has already been heated, is a real one, since the higher the temperature to which this air is heated before entering the furnace the higher, proportionally, will be the fire all through. Thus the increased temperature of the incoming air represents an actual and direct gain of heat.

The idea of preheating the air supplied to the furnaces of boilers is a very old idea, and one that has been made use of quite extensively. The usual method is to install preheaters or air heaters in the path of the flue gases in exactly the same way that economizers for the heating of feed water are installed. In fact, both pieces of apparatus perform the same function, namely, utilization of the heat contained in the flue gases that otherwise would be wasted, only in the one case air and in the other water is heated.

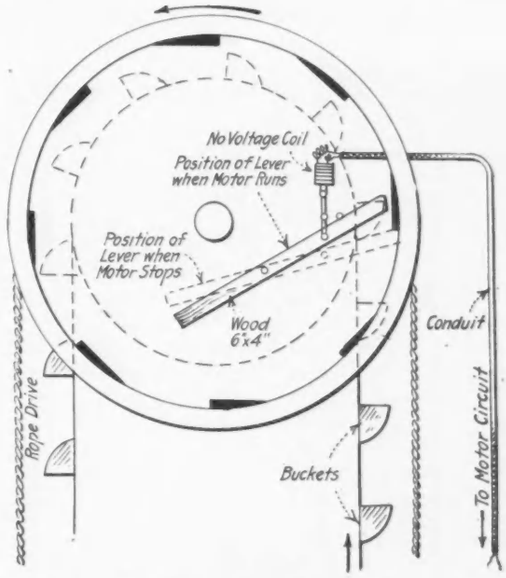
Air heaters are not used to the same extent as economizers. They are, however, used quite extensively in marine practice. The economizer is less trouble and absorbs heat just as usefully. Another reason, however, why air heaters are not more used is largely because the characteristics of the average coal are not suitable, owing to the formation of clinker.

Coals giving the most trouble on account of the formation of clinker are those whose ash has a melting point around 2400 deg. Fahr., provided, of course, that the ash contains substances that will fuse. Coals having an ash that does not melt below about 2600 deg. Fahr. will, on the other hand, give very little trouble if used in the same boiler and under the same conditions of draft and output. If the temperature of the incoming air be raised from 200 deg. Fahr. to 300 deg. Fahr. by the use of preheaters, the temperature of the fire from the ash pit through would be increased proportionally, and thus a coal having a higher melting point for its ash would probably have to be used. Such coals are not distributed so generously as are coals having an ash of lower melting point, and they are, moreover, of higher cost. For every hundred degrees of heating of the air supplied the furnace the efficiency is increased about 3 to 4 per cent, representing, therefore, a saving in fuel of about 5 per cent, and while the gain in fuel consumption is thus very satisfactory, the saving in operating expense due to this must be balanced against the possible higher cost of coal, cost of either forced draft or higher chimney and operating troubles due to clinkering. Natural draft is almost out of the question where air heaters or economizers are used because of the friction losses, etc.

The using of warm air from turbo-generators in furnaces is a different problem from the use of preheaters. The volume of air is large—about 3 cu. ft. to 4 cu. ft. of air per minute per kilowatt of rating is needed—and this air goes to waste. The temperature increase is comparatively small, usually not more than 30 deg. to 40 deg Fahr. above the incoming air, and thus insufficient to cause trouble on account of the formation of clinker, or materially to reduce the draft. If a station is laid out with provision for the use of this air, the air duct may be made short and the investment and heat losses will be small. There will be practically no additional maintenance expense, while the fixed charges will be quite small. Of course, the savings in fuel and the over-all efficiency gained are not very large either, but generally worth taking advantage of.

Scheme to Prevent Motor-Driven Elevator from Backing Up When Service Is Interrupted

It has been found that accidents often occur around electrically operated grain elevators when the power supply is interrupted if the elevator legs are not properly safeguarded. The legs when lifting grain carry full buckets on one side of the belt and empty buckets on the other. Hence there may be as much as 2 tons difference in the weight supported by the two sides. Should the driving power be interrupted, this weight,



ELECTRICALLY OPERATED RATCHET PAWL TO PREVENT ELEVATOR LEGS FROM BACKING UP

acting through the bucket-bearing belt, turns the conveyor in the reverse direction. The result is twofold. The grain in the buckets is emptied into the pit beneath the floor, and the speed of the conveyor, which may be 300 ft. long, is apt to become so high that the driving motor will be wrecked by centrifugal force.

A scheme which has been devised by Nels Joleen of the Commonwealth Edison Company, Chicago, to prevent grain-elevator legs from backing up when the energy supply is interrupted is shown in the accompany-

ing diagram. In the sheave over which the bucket conveyor turns a ratchet actuated by a no-voltage release coil is placed. As soon as the energy supply to the motor is interrupted the coil, which is fed from the motor circuit, drops the ratchet pawl and locks the sheave so that it cannot turn backward. When the energy supply is re-established and the motor started again, the ratchet becomes inoperative. This arrangement has been used successfully on large Chicago grain elevators, and is also applicable in many other places where bucket elevators are operated.

Voltage Variations That Were Traced to Loose Pulley on Generator

By E. C. Parham

An alternating-current voltage of 440 volts provided for power purposes is not a convenient voltage for incandescent lighting, but where such a voltage is available it is customary to obtain a suitable lighting voltage from a lower tap of the power transformer or from a separate transformer installed for lighting. Where a 220-volt circuit is available, however, even if the transformer has no 110-volt tap and it is not desirable to install another transformer, lighting service can be supplied from the power transformer by using 220-volt lamps, for example.

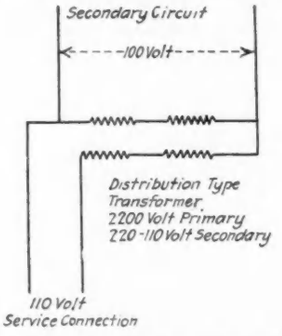
The speed of an induction motor that is supplied from a service the frequency of which varies will vary proportionately. Also variations of the supply voltage will cause motor-speed variations and lamp-brilliancy variations that may be too great to be tolerated. As an illustration of these conditions, supply-voltage variations caused a mill operator to install a small continuous-current generator the voltage of which could be regulated. The generator was belt-driven from the shop shafting, which was driven from an induction motor operated from a fluctuating supply voltage. The operator could not, of course, regulate for sudden variations incident to the starting of a heavy motor elsewhere on the service, but he could regulate very satisfactorily for voltage drops due to the heavier loads incident to dark days or to the approach of darkness at night. After installing the belted generator, it was started and brought to speed. The machine built its field magnetism in a normal manner, but on closing the switch that controlled the lamps on the generator floor the lights were observed to give a slight flicker. They were brought to normal brilliancy by means of the generator-field rheostat, and normal brilliancy was maintained. On closing the switch that controlled the lights of the next floor, however, the brilliancy of all lamps went down to practically nothing. Considerable time was spent in trying to find some trouble on the circuit that was controlled by the switch the closing of which had extinguished the lights, and more time was spent in trying to find some irregularity in the generator itself. These investigations disclosed nothing. Finally a machinist noticed that the generator shaft on the pulley end was hot and that the heat increased toward the pulley, whose hub was very hot.

Further investigation along these lines disclosed that the pulley was turning a great deal faster than the armature shaft, because the man who had installed the pulley had failed to install its key. The fit between the pulley and the shaft was sufficient to carry the load due to the lamps controlled by the first switch that was closed, but it was not sufficient to carry the load that was added by the closing of the second switch. As neither the pulley bore nor the shaft seat was damaged, the installing of the key eliminated all trouble.

Booster Arrangement for Lighting Circuits

By K. B. Humphrey

It sometimes happens, when a utility is extending its secondaries in a rapidly growing residence section, that one or more houses are so far away from the distributing transformer that the line drop is excessive. The usual remedy for such a condition is to increase the size of the wire or else to parallel it with another of the same size. This method is wasteful of material which might be better used on some other part of the system and which usually has to be taken down in the near future. A simple method which can be used to connect an ordinary commercial type of transformer is shown in the accompanying diagram. In all small plants there is usually an extra transformer or so which may be used in this way, and as soon as the section grows so that the primaries are extended a transformer is on the job and ready to be connected up with the high-tension wires. The voltage will be boosted from 100 to 110 with a ten-to-one transformer, or from 100 to 120 with a twenty-to-one transformer. The actual voltage will be slightly less than the figures given owing to the drop in the transformer itself. This is not a very efficient method inasmuch as all the losses are present as in the ordinary transformer, but in some cases it has been known to work out extremely well. Care must be taken to select a transformer large enough to handle the required amount of energy.



CONNECTIONS OF EXTRA DISTRIBUTION TRANSFORMER TO COMPENSATE FOR DROP IN LIGHTING CIRCUIT

Reducing Stoker Troubles by Use of Bolts Small Enough to Shear When Stoker Clogs

To overcome the breakage of stoker gears and other important parts of the firing equipment resulting from the clogging of rams through poor coal, the Worcester (Mass.) Electric Light Company has reduced the diameter of the bolts holding the bearing caps from ¾ in. to ⅜ in. This reduction in the strength of the bolts of about 30 per cent will in case of clogging permit the belts to shear off with a loud snap, thus warning the operating force of the trouble. Immediate steps can then be taken to free the ram of the solid material which has accumulated and blocked the movement of the fuel mass, without the usual damage to the equipment. The failure of the bolts requires the stoker to be shut down only a few minutes compared with half a day under the old arrangement. A hole drilled in the tuyère box also facilitates poking clinkers out of the ram cylinder. About 70 per cent of the difficulties with stokers in the company's plant arising from inferior coal have been eliminated by the reduction in bolt diameter above mentioned.

MARKETING ELECTRICITY

A Department on Selling Service and Widening the Use of Electrical Energy

Wiring Tenant Houses on a Rental Basis

How Several Companies Have Provided Electric Lighting for the Occupants of Mill Dwellings—Ultimate Sale of Installations to the Landlords

The wiring of mill tenements on a rental basis has been successfully worked out by several Massachusetts central-station companies. The Central Massachusetts Electric Company, Ware Electric Company and North

TENANT HOUSES IN MASSACHUSETTS WIRED ON A RENTAL BASIS

Brookfield Electric Light & Power Company have wired 411 houses, mostly those of the type shown in the accompanying photograph, the tenant or owner paying 15 per cent per annum as rental of the equipment, 6 per cent representing interest on the investment and 9 per cent depreciation. The total investment amounted to $12,004, or an average of $29.20 per installation. The contract provides that default in any monthly payment may be a cause for the removal of the equipment, and that the tenant or owner shall keep the wiring and fixtures insured to their full value, and will pay for any damage to the property.

A practical means of securing the lighting of mill houses has been devised by the Central Massachusetts Electric Company, Palmer, Mass., of which H. M. Parsons is general manager. Arrangements have been made with local wiring contractors to wire tenements with an average of six outlets at a flat price of $30, including fixtures. The installations consist of a three-light shower in the parlor, a two-light shower in dining-room, two side brackets in chambers, a single drop light in the kitchen, and one light in the cellar. Twenty-five-watt and 40-watt tungsten lamps are supplied and an electric flatiron is given to the tenant as a premium.

The lighting company before making the installation procures a contract from the tenant to pay 15 per cent per year for the use of the equipment, energy being supplied at the rate of 15 cents a kilowatt-hour net.

After the installation has been in use a short time, the owner is approached with the suggestion that he buy the equipment and recoup himself from the tenant through a slight increase in rent, amounting in the case of a thirty-dollar installation to 38 cents a month. This proposition usually appeals to the owner, and the lighting company is able to use the funds for further installations, for which about $6,000 is regularly employed.

The same plan has been put into effect by the Worcester Suburban Electric Company, which also installs motors on a rental basis. The State of Massachusetts has operated a number of motors at its asylum at Monson in driving laundry machinery and a stone crusher for road construction on the grounds. A carpet company near Worcester has also rented motors amounting to $2,600 in value. In both instances the purchase of the motors resulted. The company has built up its power load to a total of 3000 hp., and equipment supplied on the rental basis has been taken out in only two instances.

Chicago's Huge New 3000-Lamp Electric Flag

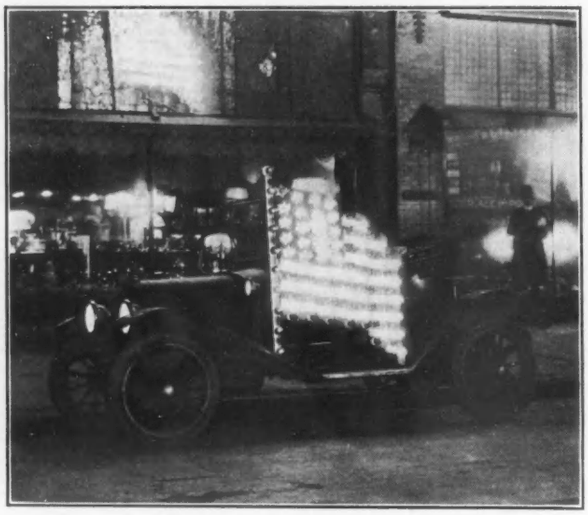
The Federal Sign System (Electric), Chicago, has just installed on the large roof-sign frame maintained by the Commonwealth Edison Company on its Market Street building, Chicago, what is probably the largest electric flag in the world. This representation of "Old Glory" measures 56 ft. in length by 54 ft. in height over all. The staff part alone is 2 ft. wide, and each star

THE 56-FT. ELECTRIC FLAG ON THE COMMONWEALTH EDISON COMPANY'S MARKET STREET BUILDING

measures 2 ft. across. There are 1155 sockets in the red stripes, 1021 sockets in the white stripes, 396 sockets in the field and 361 sockets in the pole, or a total of 2933 sockets in the flag. About 7000 ft. of wire—that is, something more than a mile of copper conductor—was used in wiring this sign. Fifteen-watt tungsten lamps are employed in the display.

Selling Electric Flags by Automobile—A Method of Reaching Outlying "Prospects"

The Toledo (Ohio) Railway & Light Company has to date connected to its lines about 500 electric-lighted flags. As pointed out in a preceding issue, many of these flags have been sold to outlying factories, stores, shops, etc. To demonstrate his wares to prospective



HOW ONE OF THE TOLEDO SALESMEN MOUNTED AN ELECTRIC FLAG ON HIS AUTOMOBILE WHEN HE WENT OFF A-SELLING

purchasers who had not access to the downtown district where many flags were already connected up and in operation, one enthusiastic flag salesman mounted an electric flag on his automobile. Arriving before the door of his "prospect," he was at once prepared to give an actual demonstration of his flag offer, while the display itself shone forth exactly as effectively as it would later appear in its permanent position on the purchaser's building.

Factory Production Increased by Electric Refrigeration

By the installation of a 7.5-hp. electrically operated refrigerating plant at the factory of the Whittemore Shoe Polish Company, Cambridge, Mass., it became possible to manufacture blacking every working day in the year, according to a statement by Mr. Eugene Carpenter of Newton, Mass., at the recent "question-box" convention of the New England Section, N. E. L. A. Before the electric refrigeration service was provided it was necessary on certain days, when the polish would not harden, to dismiss the employees of the factory pending more favorable weather conditions.

At Taunton, Mass., the output of another factory was doubled by the installation of a 25-hp. refrigeration plant. Mr. Carpenter said that while the future holds hope for thoroughly satisfactory domestic applications of motor-driven ice-making equipment on central station circuits, it is at present not economical to install such equipment in New England unless 1000 lb. or more of ice-making capacity per day is required, at a rate of, say, 5 cents per kilowatt-hour. J. E. Gray, Narragansett Electric Lighting Company, Providence, R. I., said that all the principal wholesale beef establishments and a number of markets are using electric refrigeration successfully in Providence, central-station energy being employed.

The "Active-Room" System of Rates

A Discussion of Some of the Advantages of the Form of Schedule in Use in Detroit, Kansas City, St. Louis, Milwaukee and Minneapolis

Fixed elements in the cost of residence service are a large and controlling factor in the price of such service to the customer, was one of the points emphasized by A. C. Babson, manager of the Wisconsin Gas & Electric Company, in his paper on residence-service rates, presented before the recent convention of the Wisconsin Gas & Electric Association.

Mr. Babson urged that the rates charged should have a closer relation to the cost of furnishing the service, and he discussed some of the advantages of the "active" or counted-room rate, which is employed in a number of American cities, including Detroit, Kansas City, St. Louis, Milwaukee and Minneapolis. One of the chief disadvantages of this form of rate is that it requires numerous rules to guide its applications, some of these rules being difficult to explain to customers. The general advantages of the counted-room rate system were, however, summarized by Mr. Babson as follows:

DOES NOT PENALIZE USE OF APPLIANCES

1. The counted-room rate does not penalize the use of convenient and decorative lamps, nor the use of electrical appliances.

2. The room rate does not require frequent inspections of customer's premises. The number of rooms in a house does not change, unless alterations or additions are undertaken, and such changes may be observed by external inspection.

3. The maximum demand of a residence district appears to be more nearly a function of the number of active rooms than of the floor area, connected load, or number of outlets.

4. Service which is limited as to maximum use is never as desirable as service which can be used when and as wanted. The room rate does not limit use.

COMPLETE WIRING OF DWELLING ENCOURAGED

5. Instead of discouraging the complete wiring of a house, as is the case when the demand element is based upon number of outlets, the complete wiring of the house is, under the rooms schedule, encouraged.

6. The room rate does not require the installation of additional expensive metering devices.

7. The room rate is superior to the increment or block rate because it equalizes the cost of service as between various classes of customers, and gives every customer the same opportunity to secure lower unit rates by improvement of load factor. Under the room rate, the quantity of energy required to be used at the primary rate is proportionately larger in large homes than in workmen's cottages. Both pay a demand charge in proportion to the cost to serve. Under this rate, unless the use of light is unusually economical, energy consumed by appliances is automatically charged for on the secondary step. Increment or block rates by their very nature fail to encourage use of the service beyond the minimum amount necessary for the customer's needs, and do not, therefore, promote better load factor.

BILLS MORE NEARLY CONSTANT THROUGHOUT YEAR

8. Under the active-room schedule the amount of energy to be paid for at the primary rate remains constant and does not change with a change in the rated capacity of the connected load resulting from the use of lamps of high efficiency or the addition of appliances. An increase in consumption such as is caused by the dark hours of the fall and winter months does not cause a proportionate increase in the bill, nor does such in-

creased consumption cause a proportionate increase in unit cost of service. The charge for service is stabilized and the likelihood of complaint is lessened. The rate encourages better illumination and higher intensities.

9. By proper design and selection of constants the active-room rate will provide in the charge for energy paid for at the primary step, for all customers' costs incident to adding the customer to the system, and likewise the demand costs proportional to the demand. Such a rate will continue to provide the revenue to meet the costs, notwithstanding changes in the efficiency of energy-consuming devices.

In Minneapolis, said Mr. Babson, a room rate in 1912 superseded a load-factor rate based upon connected load, with the results shown in the accompanying table.

TABLE SHOWING EFFECT OF CHANGE TO "COUNTED ROOM" RATE AT MINNEAPOLIS

	Connected Load Rate, 1912	Counted Room Rate, 1915	Increase, in Per Cent	Decrease, in Per Cent
Number consumers (average).	8,756	18,961	116.0	...
Connected load (average), kw.	1.32	0.7	....	47.0
Annual consumption per consumer, kw.-hr.	315	285.6	....	9.3
Average annual use of connected load, hours	238	407	71.4	...
Average income per kilowatt-hour	$.0963	$.0781	...	19.0
Average annual income per connected kilowatt	$22.88	$32.11	39.0	...

What It Costs to Operate an Industrial Electric Truck

Clarence E. Ogden of the Walker Vehicle Company, Chicago, in speaking on the electric industrial truck before the new-business co-operation committee of the Ohio Electric Light Association at Springfield on March 15, said the total operating cost of one of these electric industrial trucks is approximately $1 per day, divided as follows:

Depreciation at 10 per cent	34 cents
Interest at 6 per cent	15 cents
Tire renewals	14 cents
Battery renewals, lead cells	40 cents
Battery renewals, nickel-iron cells	28 cents
Electric energy at 4 cents	20 cents
Repairs at $10 per year	4 cents

These figures were based on 300 days per year use of the truck. The electric industrial truck referred to in Mr. Ogden's paper is considered the successor to the hand truck, and has found a wide field of usefulness in railway terminals, on wharves and in many industries where the rapid transportation of boxes and packages is necessary.

"Washday" and Electric-Washer Advertising

In connection with a recent demonstration and sale of electric washing machines, a Middle West dealer demonstrated the value of local newspaper and circular advertising to interest his prospective customers, when properly timed so as to find the addressees in a receptive mood. Circulars and circular letters were mailed to reach the "prospects" on Monday, which was the usual "washday" in the vicinity, the delivery of this mail matter being, moreover, so timed that the housewife would receive her circular in the afternoon. When the selling arguments of the labor-saving washer were thus read after a hard day's work over the washtub, they did not fail to receive sympathetic attention. The same idea was also taken advantage of in planning newspaper advertising during the campaign, and it was found, for example, that a washer "ad" in the Monday evening paper brought more results than the same copy used on Friday morning.

Flood-Lighting Rushes Building Construction at Champaign, Ill.

A store building which will occupy a space 132 ft. square on one of Champaign's business streets will be ready for its tenants in July as a result of the fact that flood-lighting is being used to help the night force at work. On two corners of the 132-ft. square space 500-

FLOOD LAMPS ON WALL AND ON 20-FT. POLE, USED TO EXPEDITE CONSTRUCTION WORK

watt projectors are mounted on 20-ft. poles. These lamps supply the greater part of all of the light. But at one side of the excavation three other lamps are installed on an adjacent brick building. For reflectors these lamps were hooded with common tin pans as a temporary emergency measure. The use of the pans as substitutes for reflectors did not prove a great success, however, for they soon became coated with rust and lost their reflecting surfaces.

A Fifty-Day House-Wiring Effort at Providence, R. I., Coupled with a Nine-Day Sale of Lamps

The Narragansett Electric Lighting Company of Providence, R. I., conducted a fifty-day house-wiring "drive" last year, which resulted in the addition of 427 new customers to the system, with a connected load of about 458 kw., representing an estimated annual increase in revenue of $5,124. The average investment per contract was $106.46. Circular letters describing the wiring proposition were sent to 3500 property owners not using electric service, accompanied by a return post card. One salesman took seventy-five contracts, another took fifty-seven, another fifty-two, and three between thirty and forty each.

Overlapping the company's efforts on the house-wiring campaign was a special reduction sale of lamps during a nine-day period. Because of the volume of other work this sale was conducted along somewhat different lines from those of a year before. Instead of depending entirely upon the efforts of the company's own men, coupled with newspaper announcements, the company circularized its 22,000 customers, presenting a personal appeal for business and emphasizing primarily the 25 per cent reduction allowed on all sizes of lamps from 25 watts to 1000 watts inclusive. Each customer received a self-addressed return envelope and a blotter.

There were 736 direct responses, calling for about 9000 lamps at a total cost of $1,903.91. The total lamp sales during the nine days, which included those distributed as a result of telephone or personal calls, was 40,603. A large percentage of the responses came from residential customers, and invariably 40-watt or 60-watt lamps were purchased, whereas a year ago the sizes below 40 watts were more in demand.

Electric Heating-Pad Comforts for the Sick

During a recent sale of electric heating pads one of the large display windows of the United Electric Shop, New York City, was trimmed to show the applications of electricity in the sick room. The display, in addition to calling attention to the many and efficient uses of the electric pad, also emphasized the usefulness of electric vibrators, radiators, toasters and grills, showing how toast and other food might be prepared at the side

HEATING PADS, TOASTERS, STOVES, HEATERS AND STERILIZERS WERE SHOWN IN THIS DISPLAY OF ELECTRIC CONVENIENCES FOR THE SICK ROOM

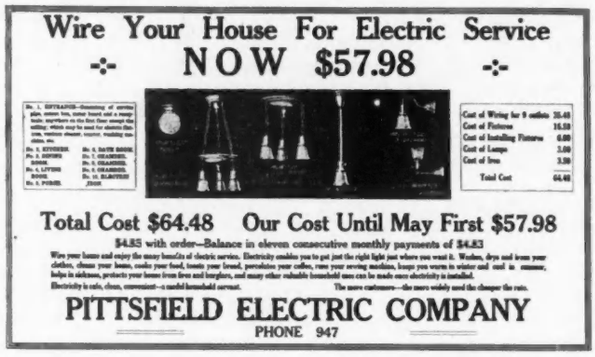
of the sick bed. Electric sterilizers, immersion heaters, egg boilers and disk stoves were also exhibited. With the co-operation of a neighboring druggist, this display was carried out even to the detail of showing a quantity of drugs, bandages, surgical instruments and miscellaneous sick-room requisites, and illustrating the simplification of the processes by the the use of electricity.

Forestalling Complaints Before the Bills Go Out

Cards that come from the meter readers of the Columbus (Ohio) Railway, Power & Light Company carrying the latest readings of customers' meters, pass through what is known as the load-curve department on their way to the billing department. It is the duty of the load-curve department to scrutinize these cards carefully to determine whether any customer's bill seems unduly high. Cards on which the reading appears "suspicious" are held in the load-curve department until it can be determined definitely that the high charges are correct. When bills for these charges are sent out the entire record of investigations and tests, made on the premises of customers whose bills were seemingly high, is turned over to the complaint department. Then if a controversy arises the man handling the case has all data at hand with which to effect a definite and fair settlement of the case.

Pittsfield Advertises Its Typical Installations to Wire More

The spirit of the campaign that is being energetically waged in Pittsfield, Mass., to win new residence customers for the Pittsfield Electric Company is well seen in the accompanying half-page house-wiring advertise-


Wire Your House For Electric Service
-:- NOW $57.98 -:-
Total Cost $64.48 Our Cost Until May First $57.98
$4.83 with order—Balance in eleven consecutive monthly payments of $4.83
PITTSFIELD ELECTRIC COMPANY
PHONE 947

THE EQUIPMENT OFFER OF THE PITTSFIELD COMPANY AS ADVERTISED IN THE LOCAL NEWSPAPERS

ment, which appeared in the Pittsfield *Daily News*. Every effort is made to establish a contact as closely as possible between the "prospect" not yet secured and the man whose home has recently been wired. Recognizing that the picture of a house already wired for a stated amount of money carries to the average reader a far

If This Man Can Have Electric Service, Why Not You?
This House Was Wired for Electric Service at a Cost of
$45.35/100
How Much Will It Cost You to Have Your House Wired?
$12.92/100
MAKES A GOOD START.
HOUSE OWNED BY FRANK J. HALFORD
30 Chickering Street
If Mr. Halford Had Taken Advantage of Our Easy Payment Plan He Could Have Payed For It as Follows:
$3.77 With Order
—AND—
BALANCE $3.77
For Eleven Consecutive Months Until Paid For.
WE ARE GLAD TO SUBMIT AN ESTIMATE WITHOUT OBLIGATION ON YOUR PART.
PITTSFIELD ELECTRIC COMPANY
TELEPHONE 947.

A PICTURE OF A HOUSE THAT HAS BEEN EQUIPPED MAKES THE HOUSE-WIRING OFFER MORE TANGIBLE TO THE INTERESTED "PROSPECT"

more definite impression of the actual cost of wiring than any possible schedule of prices, this method has been followed consistently through the campaign and with never-failing good results. For while a price schedule is abstract and indefinite, the typical house is not—and hence the power of its influence as an advertisement.

Securing Prospective House-Wiring Customers at $1 Each

The Sandusky (Ohio) Gas & Electric Company, during "Wire-Your-Home" month, is giving a carton of tungsten lamps or $1 cash for each name of a prospective customer if the prospect can be made a customer within thirty days. If two or more persons turn in the name of the same prospective customer the first to turn in the name receives the prize. E. A. Beckstein, manager of the company, in commenting on the plan declared that it looked very promising to him. "For," said he, "if the company can secure 500 live prospective customers for $500 I shall consider the investment a good one."

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Fundamental Magnetic Laws

The Kennelly Reluctivity Equation and the Steinmetz Hysteresis Law Declared to Be Exact—Apparent Discrepancies Explained by Non-Homogeneity of the Material—Properties of Silicon Steel

PROBABLY the two most valuable magnetic laws which we have to-day are the reluctivity equation of Dr. A. E. Kennelly, which is a modified form of Frölich's equation, and the 1.6 law of Dr. C. P. Steinmetz. These two laws give us our best method of attack on magnetic problems. A considerable number of test results has been obtained and much literature written attempting to show apparent inconsistencies in these laws, especially referring to the latter.

In a very interesting paper presented at a joint meeting of the Philadelphia section of the American Institute of Electrical Engineers and the Franklin Institute, Mr. John D. Ball of the General Electric Company discusses in considerable detail the apparent deviations from these laws and shows that they may be explained by the fact that they are due to lack of homogeneity of the materials tested. The idea was investigated with special reference to silicon steel since the deviations from the laws are most noticeable in this commercially important material; it is shown that these deviations are explained if the material under test is considered as what it really is, a combination of two materials, namely, silicon steel and scale.

The reluctivity law of Dr. Kennelly states that for magnetic materials the reluctivity (which is the reciprocal of the permeability when plotted against the magnetizing force H, gives a curve which, from minimum reluctivity upwards, approximates a straight line over a wide range of values. However, as pointed out by Dr. Kennelly, we find in most cases that the curve is not a straight line, but rather two straight lines joined by a sharp, decided bend. According to Ball's theory the change from one straight line to another straight line indicates that the test sample represents two magnetic materials, one of which takes most of the flux first, and the other carries the additional flux after the first is presumably saturated, or the permeability of the second part begins to increase much more rapidly than in the first.

The Steinmetz hysteresis law states that $h = \eta B^{1.6}$ wherein h = the hysteresis loss per cycle in ergs per cm.^{3} and B = the maximum induction and η = a numerical coefficient depending upon the material. According to this law the relation between log h and log B should be represented by a straight line. For practically pure nickel this holds true, but for a typical silicon steel it does not hold exactly true, as shown in Fig. 1. The solid curve represents the observed data, and the dotted continuation of the straight line shows what results might be expected if the law were absolutely correct. If we assume that the 1.6th power law holds, we see that to about B = 10,000 the flux enters a material of certain characteristics, but beyond that point the more appreciable amount of the flux is going through some magnetically harder material characterized by greater reluctivity and a higher value of η.

The most prominent deviations from the reluctivity and hysteresis laws do not occur at the same value of the magnetizing forces, nor would it be expected. The bend of the reluctivity curve would be predicted at a value of H where one material approaches the saturation value. The rapid increase of the hysteresis loss would occur at a point where the permeability of the harder material (which is characterized by the greater value of η) increases at a more rapid rate than the permeability of the softer metal. This change would be expected at about the value of H, where the softer material reaches maximum permeability, although not necessarily at this point. Beyond this, additional H gives less relative increase of induction, while the relative induction in the second material continues to increase until its permeability is a maximum, which occurs at a much higher value of H.

To test this theory further the two different magnetic materials of which typical silicon steel consists must be

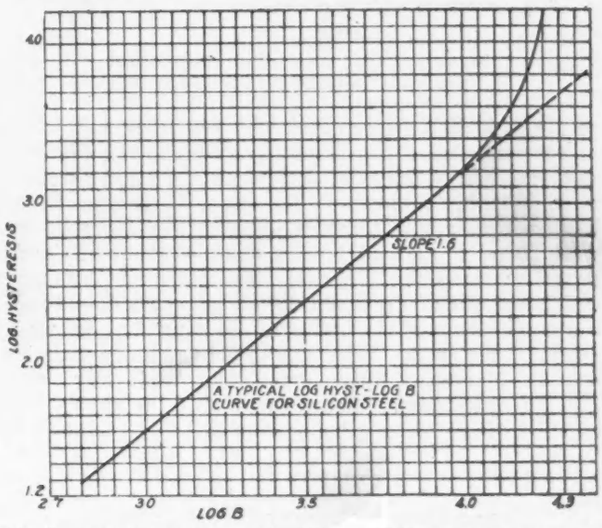


FIG. 1—DISCREPANCIES FROM THE HYSTERESIS LOSS LAW FOR SILICON STEEL

defined and investigated separately. These are silicon steel itself and the scale which is formed when the steel is heated and the exposed surfaces combine chemically with the surrounding gases. The author, therefore, investigates separately the properties of the silicon steel and the scale. While for the detailed data the reader must be referred to the original paper, the chief results of the magnetic tests of the scale alone shows that the loss in the scale itself apparently follows the Steinmetz law and that from maximum permeability the reluctivity curve of the scale is practically a straight line.

On the basis of the characteristic figures determined for silicon steel proper and for the scale, the author shows that the magnetic behavior of commercial silicon steel is explained if the latter is considered as a system of steel with 10 to 20 per cent of scale. This represents the facts.

In order to test the theory still further, tests were made of two materials as nearly pure as could be obtained. A solid ring of iron and a solid ring of cobalt were selected, and tested separately as well as together.

The results of the hysteresis test are shown in Fig. 2. The iron and the cobalt separately follow the Steinmetz law exactly, but the two materials tested together show the characteristic deviations from the law. The evidence seems conclusive.

Some investigations were also made on the hysteresis loss under unsymmetrical loops and the following inter-

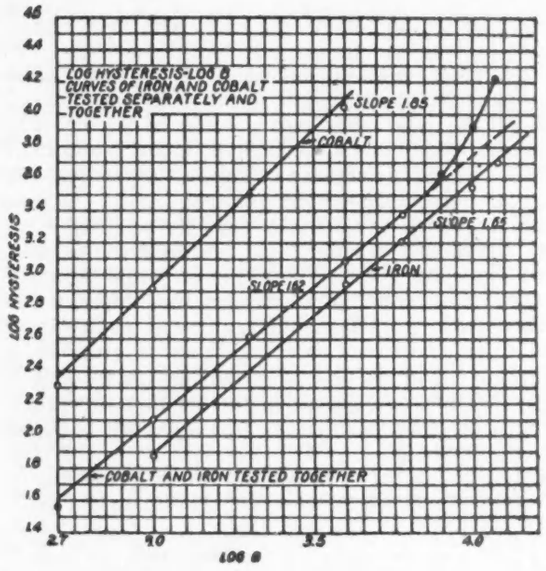


FIG. 2—CURVES SHOWING THE HYSTERESIS LAW FOR IRON, COBALT, AND THEIR COMBINATION

esting deductions were obtained. The hysteresis loss in an unsymmetrical loop is greater than the loss in a symmetrical loop of the same difference of limiting value of flux. Within the limits of the tests, the losses of loops having the same difference of limiting values of flux were found to increase with a definite power of the average or mean flux density. The increased loss as a definite power of the mean flux density was found to be the same for any difference of limiting flux values or range of the loops. With any given value of mean density the increased losses with increased range were found to increase as definite power of the range, irrespective of the mean value of density.

Generators, Motors and Transformers

Wave Shapes of Alternators.—A. E. CLAYTON.—The conclusion of his fully-illustrated paper on the wave shapes obtaining with alternating-current generators working under steady short-circuit conditions. The paper deals in detail with the action of single-phase and polyphase alternators, and both salient-pole and cylindrical-field alternators are considered.—London *Electrician*, March 3, 1916.

Alternating-Current Commutator Machines.—ALFRED WINKLER.—A mathematical article illustrated by diagrams in which the author applies the theory of local and concatenated stray fluxes to the development of vector diagrams for commutator machines. Two examples are treated, namely, the three-phase induction motor with the rotor short-circuited over a commutator, and the repulsion motor with armature excitation.—*Elek. u. Masch.* (Vienna), Jan. 2, 1916.

Direct-Current Armatures.—F. LEYERER.—An illustrated English translation in abstract of his recent German paper on methods of chord winding for continuous-current armatures.—London *Electrician*, March 3, 1916.

Transformer Design.—F. NIETHAMMER.—The author summarizes the exact formulas for the calculation of the additional losses due to eddy-currents in transformer copper, for comparison with the approximate formulas of Vidmar.—*Elek. u. Masch.* (Vienna), Dec. 19, 1915.

Installations, Systems and Appliances

Electricity Supply in the British Colonies.—The annual tables of the electricity supply in the British Colonies giving data on 198 electric supply stations and twenty tramway stations. For each station data are given in sixteen columns on history, equipment, distribution system, rates, etc. There is also an editorial on the subject. The British colonial supply stations include the Canadian Falls of Niagara, with an aggregate plant capacity of 300,000 kw., Montreal and Shawinigan with 204,000 kw., The Hydro-Electric Commission of Ontario with 179,675 kw., Vancouver 126,000 kw., Hamilton 53,000 kw., Winnipeg 51,600 kw., and Victoria (B. C.) with 22,000 kw. In the Australian Commonwealth considerable expansion is also noticeable. In Victoria, which is perhaps the most highly developed of the States from the electrical point of view, the sum of over $15,000,000 has been spent on electricity supply works alone, in addition to plants for electric tramways and railways, mines and collieries. Numerous small stations are springing up in the British colonies working by means of oil engines or oil plant. Attention is called to the diversity in the frequencies used. There are such frequencies as 40, 45, 48, 50, 60, 66, 76, 83, 125 and 133, apart from the commonly-adopted frequencies of 50 and 60. In regard to tariffs, those based on floor area find favor with some undertakings. Thus, at London (Ontario) a floor space charge of 3 cents per 100 sq. ft. of floor area is made. For this purpose outside dimensions are taken, omitting bay windows and similar projections. The area derived from such dimensions multiplied by the number of floors and reduced by 10 per cent gives the net area. The charge for energy is at the rate of 2 cents per kilowatt-hour up to an amount equal to 4-kw.-hr. per 100 sq. ft. for the first 1000 sq. ft. and 3 kw.-hr. for each additional 100 sq. ft. of floor area charged, and 1 cent per kilowatt-hour for all additional consumption per month. "In the past a great deal of German and American plant has been used in the various supply undertakings, but there is now a reaction in favor of British goods, especially in Australia." There is also a table of fifty "foreign" tramway stations chiefly in South America.—London *Electrician*, March 3, 1916.

Electromagnetic Separation.—E. F. RUSS.—A review of the development of electromagnetic separation with special reference to the Wetherill separator. Tables are given showing the properties of paramagnetic elements and of diamagnetic elments as well as a list of various mixtures of minerals which can be treated successfully by electromagnetic separation.—*Helios*, Jan. 2, 1916.

Units, Measurements and Instruments

Permeameter for Straight Bars.—ROBERT BEATTIE.—The author agrees with Campbell and Dye that for certain tests the simplest method of determining H is to withdraw or reverse a small search coil placed alongside the bar at its center. The author first constructed a permeameter on the withdrawable-search-coil plan for the ballistic testing of straight steel rods for retentivity and coercive force. The magnetizing coil is in two parts (*MM*, Fig. 3), separated by a gap *G*, to allow of the introduction and withdrawal of a narrow *H* search coil. This search coil is either U-shaped or V-shaped, according as the test bar is round or square, and is placed astride the bar at its center in the manner shown in the illustration. The *B* coil, as usual, embraces the bar at its center, or is wound in two sections displaced a little to either side of the center. To insure that the

field in which the H coil lies is as uniform as possible in a radial direction, the inside diameter of the magnetizing coil is made considerably greater than the diameter of the test bar. The uniformity of the magnetizing field is disturbed near the gap. One merit of the search coil method of measuring H, however, is that the magnetizing field need not be uniform except in the immediate neighborhood of the B and H coils. The curves of Fig. 4, moreover, show that it is possible to have a gap sufficiently wide to admit a narrow search coil and yet leave the field substantially uniform over a length of from ¼ to ¾ in. at the center of the test bar. Fig. 4 represents the variation of the applied field —that is, the field due to the magnetizing coil alone; but as the test bar in the apparatus is fairly long the true or resultant field in which demagnetizing actions are taken into account is not likely to be much less uniform near the center of the bar. If desired, the region of uniform H can be extended by the use of properly adjusted compensating coils, CC, in series with the coils MM. The effect of these compensating coils in levelling up the

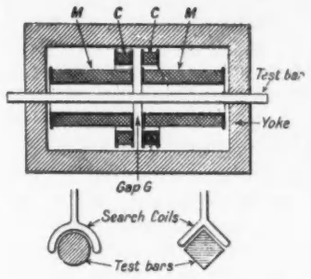


FIG. 3—PERMEAMETER

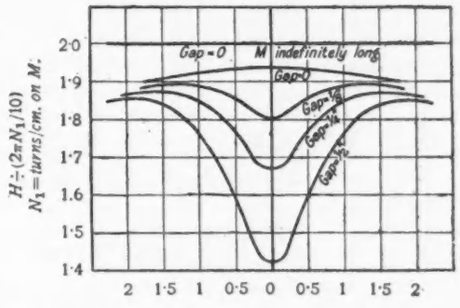


FIG. 4—MAGNETIZING FIELD CURVES

field is seen in Fig. 5. It should be possible by the proper spacing of several such compensating coils, or by varying the winding depth of the main coils, MM, from point to point, completely to annul the disturbing effect of the gap and to secure a practically uniform applied field over a large fraction of the length of the bar. An objection to the search coil method of measuring H is that it reavels the magnetic properties of the

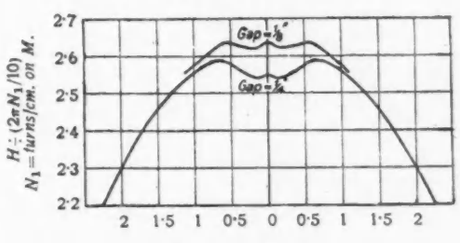


FIG. 5—EFFECT OF COMPENSATING COILS

specimen at one section only. To get an average result a test bar a few inches longer than is necessary should be used, and measurements made at several different cross-sections by sliding the test bar along ½ in. or so between successive tests. In all but specially accurate tests a fluxmeter may be used in the B coil circuit with advantage. The procedure in determining the residual induction B_r and the coercive force H_c is then greatly simplified. Reversing the maximum magnetizing current with the fluxmeter shunted so as to reduce its sensitiveness to one-half gives B_{max}. The shunt is then removed and the magnetizing coil circuit broken. The remaining deflection measures B_r, subject, of course, to correction for any small demagnetizing force that may exist. Finally, the magnetizing current is reversed and gradually increased till the fluxmeter returns to its initial position, when the H coil is withdrawn and the resulting throw measures H_c.—London *Electrician*, March 3, 1916.

Magnetic Tests of Ring-Formed Samples—EDY VELANDER.—If in the determination of magnetization curves by the ballistic galvanometer method an iron ring is used, the magnetic field intensity is not distributed uniformly over the cross-section of the ring. This is a source of error which depends not only on the form of the cross-section and the dimensions but also on the properties of the magnetization curve of the material at the point in question. Niethammer has given a correction formula according to which the measured mean induction corresponds to the field intensity at a distance from the center axle of the ring equal not to the arithmetic mean but to the "harmonic mean" of the outer and inner radii from the ring axle. The present author shows that this formula often gives corrections which are twice too large. At least for dynamo iron sheets and for inductions above the bending point of the B-H curve, this correction may cause an error of the opposite sign and even greater than those errors which it was to correct.—*Elek. u. Masch.* (Vienna) Jan. 2, 1916.

Measuring Electric Currents by Their Heating Effect.—S. LEROY BROWN.—A brief abstract of an American Physical Society paper the object of which is to give a description of a substitute for the hot-wire ammeter and describe its use. The essential feature of this instrument is a small coil of fine wire which surrounds the element of a sensitive resistance thermometer. This element may be a thin layer of lead oxide between two wires. These two wires are joined together in a molten globule of the oxide and upon cooling the oxide forms a junction between the wires which has a moderately high resistance. Such a resistance element is easily sensitive to a change of temperature of 0.001 deg. C. and hence is very sensitive to the heat produced by a current in the fine wire heating coil. Any method of resistance measurement may be employed to register the change in resistance of this element due to the heating effect of a current in the coil. An instrument can easily be built on this plan which is sensitive to a few milliamperes. For larger currents, the coil would be made of larger and lower resistance wire, and for very small currents a heating coil of very fine high-resistance wire can be used. The higher range of a particular coil is about ten times the lowest measurable current; that is the range may be from 10 to 100 milliamperes or from 100 to 1000 milliamperes, etc. The above described method of measuring electric currents has been used for the following purposes: as a comparator for the calibration of alternating-current instruments by comparison with direct-current standards, for measuring high-frequency currents, for the experimental determination of the effect of coupling, tuning, etc., in the generation of electric waves.—*Phys. Rev.*, March, 1916.

Double Dynamometer Wattmeter.—C. V. DRYSDALE —In a continuation of his article the author gives technical and experimental data and the results of load tests of his double dynamometer wattmeter. He mentions a method of compensating for the small interference between the two systems and refers to another exceedingly ingenious method of compensating for interference

between the systems of a double wattmeter devised by Dr. Weston and employed in his double deflectional wattmeters. It is simply to include a third small resistance between the junction of the pressure circuits of the two wattmeters and the third lead, instead of joining them both directly to the main itself. The present author gives briefly a mathematical theory of the Weston method of compensation. He finally takes up the discussion of various applications of the double wattmeter.—London *Electrician*, Jan. 21, 1916.

Oscillograph.—An illustrated description of an oscillograph outfit of English make which has been designed to operate directly, and without the introduction of a transformer, with potentials up to 110,000 volts.—London *Electrician*, Feb. 11, 1916.

Tesla Coils.—W. MORRIS JONES.—It is generally assumed that a Tesla coil gives the best effect (i.e., the highest secondary potential for a given primary discharge potential) when the two circuits are so adjusted that, separated, their periods of oscillations are equal. This condition is expressed by the relation $L_1C_1 = L_2C_2$ and is commonly called the condition for "resonance" or "synchronism." In a recent paper Taylor Jones has shown that the above condition does not apply if the adjustment is made by varying the primary capacity alone, but that in this case the "optimum" value of C_1 is considerably greater than the resonance value. The author gives the results of an experimental investigation in which the chief conclusions of the theory were confirmed.—*Philos. Magazine*, January, 1916.

Comparison of Mutual Inductance and Self-Inductance.—C. H. LEES.—A brief abstract of a (British) Physical Society paper on a general bridge method for comparing the mutual inductance between two coils with the self-inductance of one of them. It is shown that the self-inductance L of a coil of resistance S may be compared with the mutual inductance M between the coil and another by making the first coil one arm of a bridge, $PQRS$, of which the second coil and a resistance $U + V$ in series form one diagonal, the galvanometer forming the other. The cell is connected through a key to the point of contact of U and V. When the steady balance has been obtained U or V can be varied so as to get an induction balance for any value of L/M without P, Q, R or S having to be changed. Then $L/M = -[Q + S + (I + Q/P)\ V]\ (T + U)$.—London *Electrician*, Feb. 25, 1916.

Selenium Cells.—W. R. COOPER.—A continuation of his fully illustrated article on selenium cells. The dependence on wave-length is first discussed—that is, the fact that generally the part of the spectrum including the yellow-red rays is more effective in its photo-electric effect on selenium than any other. The author gives various statements of the law of the variation of the light effect and then discusses sensitiveness. High sensitiveness is only obtained along with high resistance—the lower the resistance the lower the sensitiveness—which fact limits the usefulness of selenium for many purposes. When, for instance, the action required is the working of a relay, it is not so important to know the "sensitiveness" of the selenium as it is to know the additional current it will yield under a given illumination. A set of standard conditions for testing selenium cells is next given. The article is to be concluded.—London *Electrician*, Feb. 18, 1916.

Selenium Cells.—W. R. COOPER.—The conclusion of his paper on selenium cells. The author gives a review of the theories proposed on the action of light on selenium cells and then deals with the construction and the practical applications of selenium cells.—London *Electrician*, Feb. 25, 1916.

Classification of Single-Phase Alternating-Current Motors

To the Editor of the ELECTRICAL WORLD:

Sir: W. C. K. Altes states, on page 1368 of the ELECTRICAL WORLD for Dec. 18, 1915, that "a classification of single-phase alternating-current motors satisfactory from a scientific standpoint has been given by E. Arnold . . ." and that my "energetic attempt to base such a classification on a popular theory instead of on scientific analysis is objectionable. . . ." Mr. Altes also expresses the hope that the translator of Professor Arnold's book "will find suitable English words for his classification."

It is incomprehensible to me how Mr. Altes can make such statements. He either does not know German and has not read the book he refers to, in which case I am at a loss to understand how he can say that Professor Arnold's classification is satisfactory from a scientific or from any other standpoint, or he has not read the paper he undertakes to criticise. In support of my contention, I think it will be quite amusing and instructive to present Professor Arnold's proposals and my corresponding ones in tabulated form, and remind those interested in this discussion that my classification was first published in 1906, long before Professor Arnold's.

Referring to single-phase commutator motors in particular, Professor Arnold suggests, on page 292 of "Die Wechselstromtechnik," Vol. 2, that these machines be classified according to the rules set forth in the left-hand column of the following table. My corresponding and earlier suggestions will be found in the right-hand column of the same table.

Readers' Views and Comments

TABLE I.—METHOD OF CONVEYING POWER TO THE ROTOR

Arnold	*Fynn*
1. Directly fed machines.	1. Conduction machines (my rule 22).
2. Indirectly fed machines.	2. Induction machines (my rule 23).
3. Doubly fed machines.	3. Induction-conduction machines (my rules 22 and 23. See also my Figs. 23, 37, 43).

Referring to Table I, it should be pointed out that on pages 290 and 291 of Professor Arnold's book it is explained that a "directly-fed machine" is one in which the energy is conveyed to the rotor by conduction, whereas an "indirectly-fed machine" is one in which the energy is conveyed to the rotor by static induction. A "doubly-fed machine" is defined as one in which energy is conveyed to the rotor partly by static induction and partly directly from the line, by conduction.

TABLE II.—ARRANGEMENT OF THE EXCITATION

Arnold	*Fynn*
a. Stator excitation.	a. Stator excitation (my rule 27).
b. Rotor excitation.	b. Rotor excitation (my rule 28).
c. Stator and rotor excitation.	c. Stator and rotor excitation (my rules 27 and 28. See also my Figs. 32, 36).

Professor Arnold's terms have exactly the same meaning as mine; see pages 291 and 292 of his book.

TABLE III.—CONNECTIONS

Arnold	*Fynn*
α. Dependent (excitation) connection.	a. Series excitation (my rule 24).
	β. Separate excitation (my rule 29).
β. Independent (excitation) connection.	Self excitation (my rule 30).
	Mixed excitation (my rule 31).
δ. Mixed (excitation) connection.	δ. .....

In Table III "dependent," as explained by Arnold on page 292 of his book, means the same as "series excitation."

Arnold's "independent" excitation is obtained directly from the line or by short-circuiting the exciting circuit of the motor, in which case the exciting current, must, of course, be due to an emf. generated in the machine itself. In this case Arnold groups my separate, self and mixed excitations under one term—a very unwise proceeding—

but clearly explains that his term covers all that is covered by my rules 29, 30 and 31.

For Professor Arnold's "mixed (excitation-) connection," I find no parallel in my proposals. It is supposed to apply to machines which have series as well as shunt excitation and which show the characteristics of a direct-current compounded or decompounded motor. When I find an alternating-current motor having such characteristics, I will think of classifying it and will probably select the term "compound" to characterize its excitation; for the moment I draw attention to the fact that when an a.c.-shunt as well as an a.c.-series excitation is applied to one and the same magnetic circuit, the flux is determined by the voltage impressed on the shunt circuit and is practically independent of the series ampere-turns.

The above comparison shows that one "difference" between the satisfactory scientific classification proposed by Professor Arnold and the objectionable classification based on a popular theory proposed by me, lies in the fact that he was not satisfied to call a spade a spade, as I had done, by referring to certain machines as "conduction" and to others as "induction" motors, but desired to express exactly the same thoughts by substituting for my direct terms others more novel but more ambiguous, and he therefore selected "directly fed" and "indirectly fed." Furthermore, Professor Arnold evidently thinks it unnecessary to differentiate between separate and self-excitation, but does think it necessary to take account of compound excitation, which, so far as I know, has not yet been achieved.

According to Mr. Altes, Professor Arnold has succeeded in converting my popular and objectionable basis for a classification into a scientifically satisfactory one, by expressing two leading thoughts of mine by different and coined terms, by electing not to differentiate between two different ways of obtaining an exciting emf., by taking into account an ineffective form of excitation, and by disregarding a number of useful rules altogether.

As to the fundamental types advocated by Mr. Altes, I have repeatedly explained my view of my Figs. 3, 4, 5 and 6, referred to by him under *A*. I have also stated my reasons for holding such views; if they are incorrect, it will be easy for Mr. Altes to point out just where the error lies, when I shall be glad to amend my conceptions. A mere assertion on his part that I am wrong is not sufficient.

Regarding my Figs. 13, 14, 15, 16 and 17, referred to by Mr. Altes under *B*, and the differences between which have all been carefully pointed out by me, the energy is in all cases conveyed to the rotor by induction, just as in my Fig. 39. Now the term "induction motor" is definitely established in connection with Fig. 39, and I therefore apply this term to all those motors in which energy is conveyed to the rotor by induction as in Fig. 39. Professor Arnold speaks of the motors here referred to by Mr. Altes, as "indirectly-fed series motors" and explains that "indirectly fed" (page 291, line 3 and following of his book) is to be applied to machines in which the whole mechanical energy is transferred to the rotor by static induction. If Mr. Altes prefers the scientific "indirectly fed" to the popular "induction," well and good, but I do hope that he will realize that both expressions stand for exactly the same thing! As between "repulsion" and "induction" it is a question of abandoning one of two well-established expressions. The term "repulsion" is meaningless and incapable of a logical definition in this connection, in view of Ampere. The term "induction" is pregnant with meaning and exactly expresses the most characteristic feature of a certain class of motors.

Referring to Mr. Altes' remarks re "the compensated repulsion motor," Professor Arnold, whose classification is so satisfactory to Mr. Altes from a scientific standpoint, refers to this machine as "indirectly-fed series motor with rotor excitation" (see his Fig. 250). I call it "single-phase series induction motor with rotor excitation." Seeing that "indirectly fed" is, according to Professor Arnold, identical with "induction," the "scientific" Arnold absolutely agrees with the "popular" Fynn, but for all that Mr. Altes is not satisfied and disagrees with both!

As to Mr. Altes' remarks under *D*, if he will refer to his authority, Professor Arnold, he will see that the presence or absence of the field winding in Mr. Altes' Fig. 48 merely means the presence or absence of stator excitation over and above the ever-present rotor excitation. Also that Professor Arnold on page 292 of his book correctly refers to the rotor brushes displaced by 90 electrical degrees from the short-circuited working or energy brushes, as exciting and not as compensating brushes. As to his Fig. 50, I have already explained that the "compounding" of single-phase motors is not feasible, except perhaps by means of very special arrangements, certainly not present in Fig. 50.

If the work of Ampere is set aside, then the only rational definition that can be given to the term "repulsion" is the same as that which is accepted for the term "induction." It is therefore unwise, to say the least, to refer to one machine as a "series-compensated repulsion" and to another as a "series-compensated induction" motor.

The Altes diagram, labeled "Fig. 51. Series-repulsion motor," is not a motor at all, but merely a very poor transformer, and need therefore not be considered here. V. A. FYNN.

[Discussion of the subject of "Nomenclature of Alternating-Current Motors" was first presented in our columns Aug. 14, 1915, at the request of the standards committee of the A. I. E. E. The later discussions in the issues of Oct. 30, Nov. 6 and Dec. 18 were summed up by Prof. C. A. Adams in our issue of Dec. 25, 1915. Mr. Fynn's closure as author of the original paper is here presented in the letter. The diagrams and figures to which he refers (which space prevents us from reproducing) form a part of the original discussion.—Editors.]

Some Opportunities for Standardization

To the Editor of the ELECTRICAL WORLD.

SIR: Standardization is coming slowly but surely into all walks of life. In no industry is this more true than in the electrical industry, where the standardization of safe operating temperatures for various types of insulation and classes of machines, testing methods, methods of classification of apparatus and ratings, overhead and underground construction, railroad crossings, etc., have already become effective and at the present time receive almost nation-wide recognition.

Standardization, if properly undertaken, is a move in the right direction. Standardization of materials and methods based upon specifications drawn up by the friendly co-operation of engineering societies and manufacturers' associations will go a long way toward better material and workmanship for less cost, lower installation expense, and less time lost in filling orders, than would otherwise be the case; and in this way capital that would be tied up is freed to be put to use elsewhere to better advantage.

Standardization is most commendable so long as over-standardization does not occur. But standardization must not be carried too far—and who shall say when that point has been reached?—especially in an industry so young and one that is developing so fast and over so vast a field as is the electrical industry, because it imposes restrictions and limitations that might tend to retard and warp normal development.

One large central-station company recently standardized the coloring of its buildings—power stations, substations, etc.—and the apparatus contained in them. This a large company is able to do to good advantage, simplifying the work of architects, engineers and builders while reducing the amount of material that must be kept on hand, at the same time lowering the price by purchasing in much larger quantities. In a matter like this the smaller company is at less of an advantage than is the large company.

Standardization of color in stations is a move in the right direction, from the economic, esthetic and practical points of view. The standardization of color should go a long way toward enabling better illumination, increased safety and more economical lighting. Many companies preach illumination but fail to practice it in their own stations, more particularly in such portions as their boiler-rooms, which are proverbially dark and dirty—often unjustly so—as well as inefficient. Things go on in the dark that would not be countenanced in the light of day, and although comparatively low efficiency, unfortunately, seems inherent to the boiler-room, better lighting will tend to improve matters very materially.

Judicious standardization means greater returns for a given investment. It spells economy and efficiency of effort, and, other things being equal, will tend to keep down the present high cost of living. R. I. ELKIN.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Walter Schwerin has been appointed superintendent of the Leavenworth Light, Heat & Power Company, Leavenworth, Kan., succeeding E. G. Stickey.

De Witt V. Moore has opened an office in the Lytton Building, Chicago, Ill., as consulting engineer, with the purpose of specializing in valuation work and cost analysis. Mr. Moore resigned recently from the position of district engineer of the central district, division of valuation, Interstate Commerce Commission, with headquarters at Chicago.

A. M. McGehee has resigned as general manager of the Tuscaloosa (Ala.) Light & Ice Company after a connection of twenty years with those interests. From 1900 to 1912 Mr. McGehee operated the Tuscaloosa Light & Ice Company as lessee, and afterward, when the property was taken over by a new corporation, Mr. McGehee remained as vice-president and general manager. He will continue as a director of the company and intends to take up the management of his other large business interests in the vicinity of Tuscaloosa.

Charles L. Edgar, who with J. B. McCall, president of the Philadelphia Electric Company, has been appointed to represent the central-station industry on the campaign executive committee for the "America's Electrical Week" celebration next December, is president of the Edison Electric Illuminating Company of Boston, Mass., with which he has been connected nearly thirty years, and a past-president of the National Electric Light Association. Mr. Edgar was born at Griggstown, N. J., and was graduated from Rutgers College in 1882, afterward spending one year in post-graduate work in electrical engineering. In 1883 he entered the employ of Thomas A. Edison, where he spent twelve months in the testing department of the Edison Machine Works in New York City. It was in 1887 that Mr. Edgar first joined the staff of the old Edison Electric Light Company of Boston as superintendent. In 1887 he was made general manager, and subsequently vice-president, and sixteen years ago, upon the death of Jacob Rogers, Mr. Edgar was elected president of the company.

C. L. EDGAR

C. D. Flanigen, general manager of the Athens (Ga.) Railway & Electric Company, has been re-elected president of the Chamber of Commerce of that city.

J. R. Hobbins, who has been with the Montana Power Company for the last four years, was recently promoted to be manager of the company's Great Falls (Mont.) property, to succeed E. I. Holland.

H. D. Frueauff has been appointed vice-president of the City Light & Traction Company of Sedalia, Mo. Mr. Frueauff was formerly general manager and treasurer of the company, in which positions he continues.

W. R. Haynie, president of the Marine Oil Engine Company, New York City, a recently organized corporation which will sell the Skandia oil engine in the United States, has just returned from an extended trip through Sweden.

E. I. Holland, who has been manager of the Great Falls (Mont.) branch of the Montana Power Company for several years, has accepted the position of general manager of the Great Falls Townsite Company, an organization also under the control of John D. Ryan, president of the Montana Power Company.

H. L. Lincoln, formerly assistant refrigerating engineer with the Commonwealth Edison Company of Chicago, has been appointed engineer for the Frost-Maker Ice Machine Company of Chicago, a company manufacturing refrigerating machinery for home and shop use. While with the Commonwealth Edison Company Mr. Lincoln spent a number of months as instructor in the Chicago Central Station Institute.

W. S. Baldwin, formerly in charge of the electrical construction department of the Syracuse (N. Y.) Lighting Company, has been appointed superintendent and assistant to the manager, L. S. Williams of the Harrisburg (Pa.) Gas Company. Mr. Baldwin succeeds C. M. Cole. Mr. Baldwin was formerly employed as construction engineer at Harrisburg and has been connected with the United Gas Improvement Company for six years as engineer.

C. E. Robertson has been appointed sales manager of the General Vehicle Company, with headquarters at the general offices of the company in Long Island City, N. Y. He succeeds C. W. Squires, Jr., resigned. Mr. Squires will remain with the organization, taking at his own request an important position in the West. Mr. Robertson was formerly a member of the commercial department of Consolidated Gas & Electric Company of Baltimore, Md.

George Drake Smith, for the last two years supervisor of agencies for the General Vehicle Company, Inc., has been appointed special assistant to Harrison G. Thompson, vice-president and general sales manager, Edison Storage Battery Company, Orange, N. J.

A. C. King, who since 1913 has been deputy commissioner of gas and electricity for the city of Chicago, has resigned to take up consulting engineering with headquarters at 714 Hartford Building, Chicago, Ill. Mr. King was graduated from the University of Wisconsin in 1901, and upon leaving school accepted a position with the Northern Electric Company at Madison, Wis. He left that firm in 1907 when it was taken over by the General Electric Company and after he had risen to the position of assistant chief engineer. From 1907 to 1911 he was engaged in independent consulting engineering work, and later became associated with Ray Palmer, who at that time was engaged in making an electrolysis survey for the city of Chicago. During the last three years Mr. King has been in charge of the city's investigation of the rates of the Commonwealth Edison Company, its valuation of the Automatic Telephone Company, and a valuation and report on electric rates and gas rates in the city of Cincinnati, which as yet is unfinished.

Ludwig Kemper, who has for a second time been elected president of the Minnesota Electrical Association, which organization he headed during 1911, is the general manager of the Minnesota Gas & Electric Company, at Albert Lea, Minn. Mr. Kemper was born in Rotterdam, Holland, in 1877 and was graduated as a mechanical engineer at the University of Delft, later taking up post-graduate electric work at Karlsruhe, Germany. After working as an industrial engineer in Europe for two years, he came to the United States and was employed for a time by the Pullman Company on car-lighting design. After a period of consulting engineering work, Mr. Kemper served as assistant electrical engineer for the Baltimore & Ohio Railroad from 1903 to 1905, and in the year last mentioned came to Albert Lea as general manager of the local property.

LUDWIG KEMPER

NEW APPARATUS AND APPLIANCES

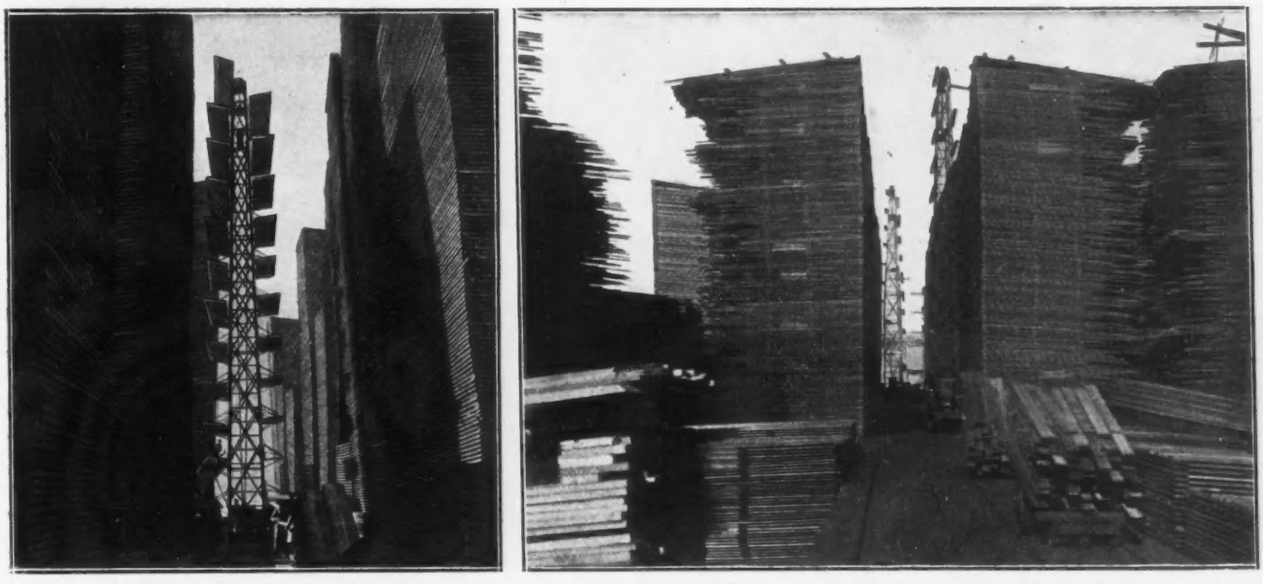
A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Portable Electrically Operated Lumber-Piling Machine

The Hilke portable lumber piler, illustrated herewith, is a machine designed and constructed to save labor and room in lumber yards. It is equipped with a continuous-chain elevator which lifts the lumber up on one side and lowers it on the other, where it is taken off at any height desired by the men building the pile. When the time comes to take the lumber down from the pile, the machine lowers the boards with the same facility and speed, it is asserted, that it piles them up. The piler will also do good work when placed alongside of a planing machine—taking the lumber from the dry kiln, transfer car or truck, and depositing it on the automatic feed-table of the planer.

The conveyor chain runs continuously at an approximate speed of 30 ft. per minute. No time is lost in beginning to pile or unpile lumber, it is pointed out, for the chain is reversible and can be started or stopped instantly by means of a throw-out switch and brake. The excellent results obtained by lumber operators who have used these machines have shown beyond any doubt, it is declared, that such mechanical stacking is the most efficient and economical method of handling lumber, and that by employing these pilers, millmen are enabled to pile and unpile their lumber at the lowest possible cost. Following are some of the advantages of the machine as enumerated by the makers:

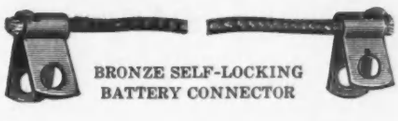
One machine will pile more than 10,000 ft. of lumber per hour to any height desired within a maximum height of the piler in use. Four men constitute a piling crew for one of these machines. By piling lumber in this manner and in higher piles, it will dry better and more quickly than when piled by old methods. Very little power is needed to operate the pilers. Machines can be built to any desired height, and are mounted on either flanged car wheels, where there are tracks, or heavy, flat, truck wheels with roller bearings. The machines are usually constructed for heights of 24 ft., 30 ft. and 40 ft. The design is strong and substantial, iron and steel being used throughout. The piler is operated by an electric motor, which can be connected through an extension cord to any outlet in the yard or mill. This lumber-piling machine has been patented by Henry C. Hilke, and is being manufactured by the Seattle Machine Works, Inc., Seattle, Wash.



PORTABLE ELECTRIC ELEVATOR WHICH LIFTS LUMBER ON ONE SIDE AND LOWERS IT ON THE OTHER

Spring Battery Connector

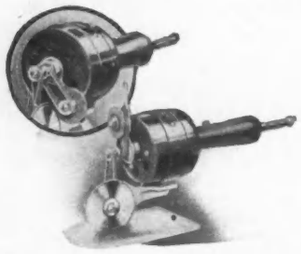
A self-locking spring battery connector which has been developed particularly for use as a terminal for magnetos, coils, spark plugs, lamps, telephone cords, horns, batteries and electric toys, is shown in the accompanying illustration. It is not necessary to solder the connector to the cord, since it is fastened to the end of the wire by a special tie, as shown. No pliers are necessary to install the connector. The device is of spring bronze and is especially well adapted for electrical work, it is pointed out, on account of the broad contact which it provides, thus reducing the external resistance, and therefore increasing the life of the battery. Only one turn of the terminal nut, it is claimed, is necessary to make a perfect contact. The battery connector has been brought out by the Hi-Po Waterproof Battery Company, 1007 Atlantic Avenue, Brooklyn, N. Y.



BRONZE SELF-LOCKING BATTERY CONNECTOR

Electric Cloth Cutter

An interesting motor-driven device which should be of especial appeal to clothing manufacturers, custom tailors and dressmakers is the cloth cutter shown herewith. The device is small and light in weight, and is operated by a universal motor. The thin circular knife revolves at a speed of 6000 r.p.m. and slips through the cloth at a speed, the manufacturer points out, limited only by the operator's ability to follow the lines of his pattern. The knife is belt-connected to the motor, as shown, insuring quiet operation. A small emery wheel is attached to the device and can be placed at right angles to the cutting blade for sharpening it.



MOTOR-DRIVEN CLOTH CUTTER

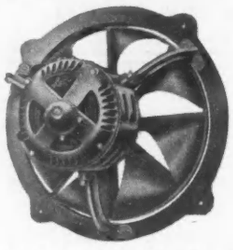
The electric cloth cutter has recently been placed on the market by the Wisconsin Electric Company, Racine, Wis.

Electric Cylinder Washer

In the accompanying illustration is shown an electrically operated washing machine of the cylinder type equipped with a folding bench for tubs and clothes basket. The machine is designed to wash about six bed sheets, or the equivalent, at one time. The cylinder in which the clothes are placed is of wood and is perforated. There are no sharp corners and consequently, it is pointed out, there is no chance of tearing the clothes. A lid is provided in this cylinder which can be raised so that the clothes can be placed inside the cylinder. There are five shelves in this cylinder that work the clothes through the water. The water is forced in and out of the cylinder through the holes and therefore through the fabric. The "White's De Luxe Junior" machine, as it is called, is being placed on the market by the White Lily Manufacturing Company, Davenport, Ia.

Adjustable-Speed Motor-Driven Ventilating Fans

In the accompanying illustration is shown what is called the Watson fan equipment manufactured by the Mechanical Appliance Company, Milwaukee, Wis. The apparatus is compact in construction. A 50 per cent speed change can be obtained with direct-current and polyphase alternating-current equipment by introducing resistance into the armature or the rotor circuit of the motor. A two-speed polyphase fan of the type shown has also been developed by the company. In this fan outfit special taps are brought out of the stator windings of a squirrel-cage motor, providing means for obtaining a speed about 20 per cent below the normal speed of the motor. The two-speed polyphase fan is especially well adapted, the manufacturer points out, for use where at times ventilation in excess of normal is required.



TWO-SPEED VENTILATING FAN

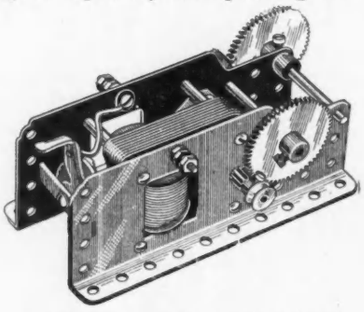
Annunciator with Shallow Case

The "San-Fer-Ann" annunciator, as it is called, shown herewith, is provided with a permanently-hinged backboard attached to which are the connectors and mechanism. The case is of ferro-steel, and is provided with an enamelled white finish. A keyed slot is employed for locking the backboard and case when the case is closed. The backboard is strong, it is pointed out, and is of non-warping construction. A feature of the device to which the manufacturer calls particular attention is the shallowness of the case, which measures only 2.25 in. from face to back. Use is made of a twin-gong, nickel-brass bell equipment on the front of the case, as shown in the accompanying illustration. The bell is provided with double-magnet lock-adjusting device and a pivoted armature. The operative mechanism for the bells is mounted inside of the case and is connected with the backboard mechanism by a flexible cable so that the bell is always in the circuit, whether the case is open or shut, thus greatly facilitating either connecting or testing. The "reset" mechanism is strong and well aligned.

The annunciator is being placed on the market by Edwards & Company, 140th and Exterior Streets, New York.

Toy Motor

The Meccano Company, 71 West Twenty-third Street, New York, has brought out a small motor which is designed especially for operating its toy model sets. The motor is provided with sides and base having standardized "Meccano" perforations so that the motor may be built into models and become actually a part of them. The driving spindle is equipped with a pulley and pinion, so that gears may be attached and the pull of the motor increased at will. The brushes are readily accessible and may be taken out when desirable.

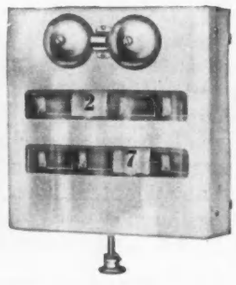


BATTERY-OPERATED TOY MOTOR

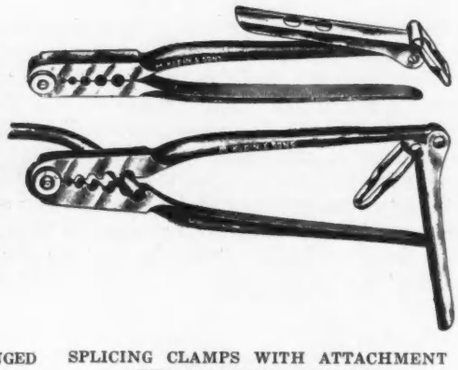
Attachment for Splicing Clamps

The "Leverlink" splicing-clamp attachment has recently been placed on the market by Mathias Klein & Sons, Chicago, Ill. The device is designed to lock the handles of the clamp after the jaws are in place over the wire, so that they can be firmly held in place during the operation of splicing. It is adapted for use as an attachment, the manufacturers point out, with any standard-sized clamp. The attachment

ELECTRIC CYLINDER WASHER WITH FOLDING BENCH



TWIN-GONG ANNUNCIATOR WITH HINGED BACKBOARD



SPLICING CLAMPS WITH ATTACHMENT FOR CLAMPING HANDLES

is riveted to one handle of the clamp in such a manner as to allow the link to slip over the other handle. By pressing down on the lever the link is locked in place and the handles of the clamp are held securely together, causing the jaws to grip the sleeve or wire, it is declared, like a vise. For large-sized wire the lever may be used to hold the handles together, as shown in Fig. 2.

Air Compressor Outfit

In Fig. 1 is shown a small electrically operated automatic air-compressor outfit which is designed to furnish a dependable supply of high-pressure air at

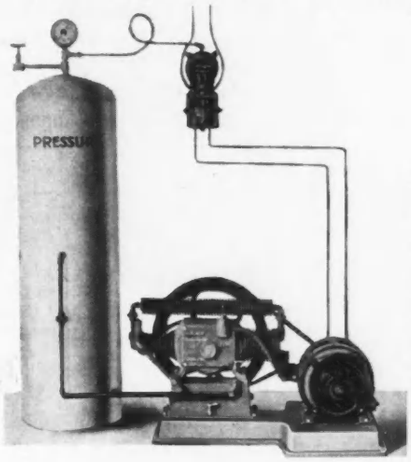


FIG. 1—GARAGE STATIONARY AIR-COMPRESSOR PLANT

all times with practically no attention, except for lubricating at long intervals. It is especially well adapted for stationary use in garages or tire shops. The set is very compact, occupying a space 2 ft. 4 in. by 4 ft. 2 in., and can be placed in a corner or on a shelf, where it is out of the way. The outfit consists essentially of a two-stage air compressor, oil trap, safety valve, motor

FIG. 2—PORTABLE MOTOR-DRIVEN AIR-COMPRESSOR

and automatic belt tightener with endless "Vim" belt, all of which are mounted on a large metal sub-base, a 30-gal. steel tank, an automatic controller gage and valves and piping, as shown in the illustration. The Type H equipment, as it is called, shown in Fig. 1, is being made in two sizes, with capacities of 4 cu. ft. and 10 cu. ft. per minute respectively. They are operated by motors with ratings of 0.5 hp. and 1 hp. respectively.

The portable apparatus shown in Fig. 2 is operated by an 0.5 hp. motor and is designed to provide 4 cu. ft. of air per minute. The tank is 14 in. by 36 in. and is mounted on the truck as shown. The truck is provided with two roller-bearing swivel wheels and two 13-in. heavy iron wheels. The portable outfit is also of the two-stage H type and is designated as an H-35 equipment.

The two air-compressor outfits described are being placed on the market by the United States Air Compressor Company, Cleveland, Ohio.

Artistic Pottery Lighting Fixtures

Artistically designed lighting fixtures in the form of porcelain vases for side-bracket, hanging and table lamps have been developed by the Glen Tor Keramic Studio, Grand View, Nyack, N. Y., of which Miss Lydia B. Godfrey is director. Three vase forms are utilized, differing essentially in size and proportions. Although the lamps recall the graceful lines of the old Greek amphora, they are not copies from the antique, it is pointed out, and possess individuality and distinct merit of their own. The fixtures are especially well adapted for use as side lamps and can

FIGS. 1 AND 2—LIGHTING FIXTURES OF AMPHORA DESIGN

be so designed or colored to blend in with or accentuate the color schemes of any room. When the vases are mounted in a tripod setting, as shown in Fig. 2, they can be utilized as reading and desk lamps. The tripods are of brass toned to harmonize with the color of the vase. The glazes are rich in color—light blue, dark blue, orange, tan and light green and old ivory. Other colors needed in any special color scheme can also be provided. Besides the above-named fixtures made by the Glen Tor Studio are a pendant centerpiece having a slender central vase with three smaller vases grouped around it, a hall fixture consisting of a hanging bowl with a suggestion of the best work of Indian pottery, a bowl hanging from a wall bracket by a hand-wrought chain, or arranged as a pendant over a desk or table and a fixture consisting of three vases grouped together and supported by a wall sconce. All the fixtures are fitted with standard lighting sockets. The Yost "Lock-Fast" plugs are well adapted for use with the portable lamps and the Wirt "Dimalite" socket can be employed to advantage with the bracket lamps.

Push-Button and Program Selectors

For use in educational institutions and other places where signal systems are employed, requiring both individual and program or group ringing of the bells, and also where it is desirable to

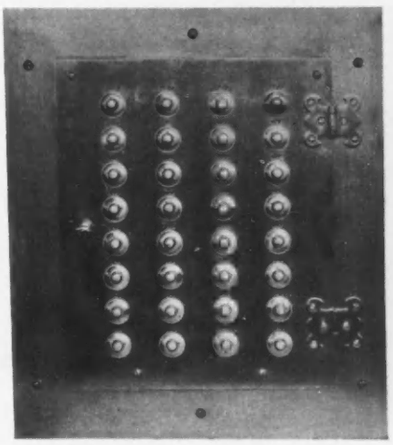


FIG. 1—PROGRAM SELECTOR WITH FOUR ROWS OF PUSH BUTTONS

change the bells from one program or group to another, the Frank Adam Electric Company, St. Louis, Mo., has developed the push-button and program selector shown herewith. It can be employed either with or without an automatic program, bell-ringing system. A very desirable arrangement, it is pointed out, can be made without an automatic ringing apparatus by utilizing one master push switch for all bells, and dividing them up in three groups; a total of four groups may also be employed. The push buttons are

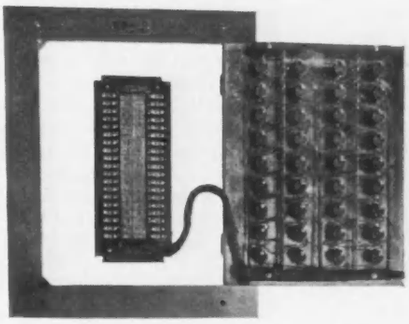


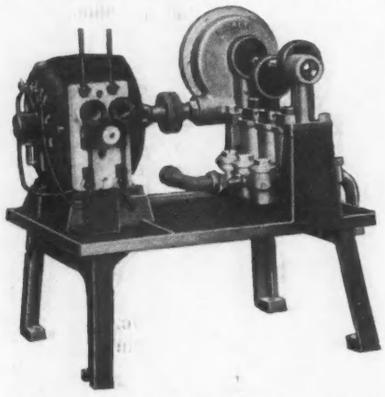
FIG. 2—DOOR SWUNG OPEN, SHOWING WIRING CONNECTIONS

provided with hard-rubber insulating parts and phosphor-bronze contact springs, which make a sliding contact with the selector ring, which is silver-plated. The ring with its hard-rubber insulating body can be readily adjusted, it is asserted, to any of the four pro-

gram contact springs on which the bell should connect, and a change from one program to another can be made by the principal or any of his assistants within two minutes without touching any of the wire connections. The push button plate proper is really the door of a cabinet front consisting of the trim and door made of ⅛-in. sheet brass and fitted with hinges and Yale lock.

Automatic House Pumps

A "Triplex No. 15" motor-driven pump, as it is called, designed especially for residence service, is shown in the accompanying illustration. The outfit



PUMP DIRECTLY CONNECTED TO MOTOR

as shown is mounted on legs, although it may be provided with wall brackets if desired. It consists of pump, motor and automatic controller which are mounted on a strong cast-iron base. The pump has a capacity of 180 gal. per hour and operates at a pressure varying from 20 lb. to 40 lb. per square inch. The dimensions of the complete outfit are 17 in. by 13 in. by 12 in. high. The legs are 6.5 in. high. The features of this pumping outfit, the manufacturer points out, are the direct drive and the "triplex" piston construction. Each cylinder is provided with its own suction and discharge valve. The suction pipe is 0.75 in. in size and the discharge pipe 0.5 in. in size. The net weight of the complete machine is 100 lb. The automatic controller is designed to place the motor in the circuit when the pressure in the tank reaches 20 lb. per square inch and to cut out the motor when the pressure rises to 40 lb. per square inch. The knife switch and fuse block are mounted on the base plate, as illustrated. The machine is operated by a 1/6-hp. motor and is being placed on the market by the Buckeye Pump & Manufacturing Company, Columbus, Ohio.

Air-Compressor Outfit for Home and Dental Use

Two interesting types of electrically operated air-compressor outfits are shown herewith. The one illustrated in Fig. 1 is adapted especially for home use for spraying the throat, nose and oral cavity and the one illustrated in Fig. 2 is intended for use in dental offices. The dental outfit, which is equipped with a two-cylinder pump, is operated by an Emerson 1/6-hp. motor and is designed to fill the 8-gal. tank which forms part of the equipment in about three minutes at a pressure of 40 lb. per square inch. The working parts of the pump are entirely inclosed and the pump casting is practically in one piece, admitting of little opportunity, it is declared, for oil to leak out. Use is made of an automatic switch and cut-off, which is designed to start the pump whenever the pressure in the tank falls below 30 lb. per square inch and to stop it when a maximum pressure of 40 lb. per square inch is reached. A greater range of pressure, however, can be obtained by tightening or loosening the spiral spring which is employed to regulate the pressure. A positive knock-out device is also provided which is designed to guard against the switch sticking and consequently keep the electric circuit closed and the motor running, after the maxi-

FIGS. 1 AND 2—HOME AND DENTAL AIR-COMPRESSOR OUTFITS

mum pressure at which the switch is set is reached. The increased pressure produced from continued operation of the motor gradually forces the knock-out against the switch mechanism and an additional pressure of approximately 10 lb. per square inch causes the knock-out device to open the circuit.

The family outfit consists essentially of the same working parts as the dental apparatus, and the entire mechanism is concealed within an enameled metal cover. As the outfit occupies very little floor space, it can be placed in a bathroom of ordinary size. The two outfits described above are being placed on the market by the Ritter Dental Manufacturing Company, Rochester, N. Y.

Automatic Controller for Automobile Lighting Systems

In engine-driven dynamos on gasoline-operated cars, the speed of the dynamo may vary from zero to 3000 or 4000 r.p.m., and it is necessary, therefore, in charging a battery and lighting the lamps to control the pressure developed by the dynamo. For this purpose the Ward Leonard Electric Company, Bronxville, N. Y., has developed a Type CC automatic controller which is provided with an automatic switch

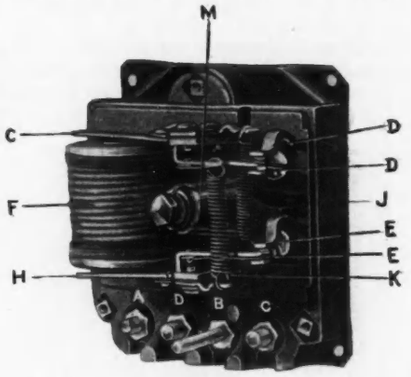


FIG. 1—AUTOMATIC CONTROLLER FOR AUTOMOBILE STARTING AND LIGHTING SYSTEMS

which connects and disconnects the dynamo to the battery. The controller shown is designed particularly for use with King cars. Control is accomplished by passing energy to the battery in a series of fluctuations. The current from the dynamo passes through the series winding *F*, and when an output of 10 amp. is reached the arm *H* is attracted and separates the contact at *EE*, thereby inserting a resistor, *M*, in series with the dynamo field. The field is weakened and therefore the output of the dynamo is reduced. When the current is reduced to 9 amp. the core *F* is not strong enough to hold the arm *H* against the action of the spring *J* and the contact *EE* is made again, short-circuiting the resistor *M*, thereby causing the field strength to be increased and the dynamo output to increase also. This cycle of operation of

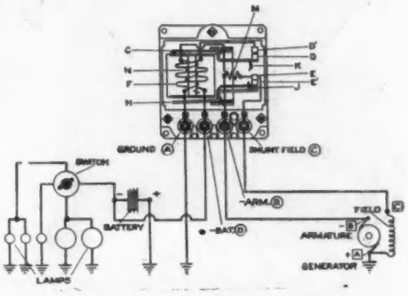


FIG. 2—WIRING DIAGRAM OF AUTOMATIC CONTROLLER

inserting and shunting the resistor *M* keeps occurring as the dynamo speed is increased. Under operating conditions the arm *H* vibrates at such a rate as to keep the current constant, it is declared, when the engine is running at a fairly high rate of speed. The cut-out

contacts *DD* connect the dynamo to the battery when the dynamo voltage is greater than that of the battery and disconnect the dynamo from the battery when the battery voltage is greater than that of the dynamo voltage. A voltage winding *N* on the same core with and underneath the series winding *F* is provided to actuate the arm *C* so as to open and close the cut-out contacts *DD*.

Lighting Generator for Gasoline Automobiles

The No. 68 generator, as it is called, placed on the market by the Carleton Company, 170 Summer Street, Boston,

AUTOMOBILE LIGHTING GENERATOR

Mass., and designed especially for automobile, motorcycle and motor-boat lighting, has been recently improved. The machine, illustrated herewith, is 6 in. long, 4.5 in. high and weighs 9.5 lb. The diameter of the case is 4 in., the pulley 2 in. and the shaft 0.375 in. The total length of the shaft is 7 in. The generator is totally inclosed and the case is a die-casting. It operates normally at a speed of 1800 r.p.m., with an output of 7 amp. at 7 volts. The generator is equipped with wick-feed oilers and is finished in black enamel.

Sewing-Machine Motor

The General Electric Company (Fort Wayne Department, Fort Wayne, Ind.) has just placed on the market a new sewing-machine motor which is provided with a long bracket arm, as shown in the accompanying illustrations, on the bottom of which are two claw-like hooks. The one claw hook is cast integral with the bracket arm and is, therefore, immovable, while the other claw hook can be adjusted by means of

FIG. 1—SEWING-MACHINE MOTOR, SHOWING LONG BRACKET ARM

a screw the knurled head of which is shown at the end of the bracket arm. When the motor is in operating position on the machine, the claw hooks enter the regular belt holes in the sewing-machine top. A few turns of the knurled-headed adjusting screw bring the claw hooks nearer together and therefore clamp the motor firmly in position. The motor rests on rubber pads and, since there are no screws or bolts, there is nothing to mar the finished woodwork of the machine. Since the claw hooks enter the regular belt holes of the sewing machine, the belt pulley of the motor and the belt groove on the sewing-machine hand wheel are automatically aligned when the motor is clamped in position. A short leather belt is provided for driving the machine.

The "Modista" motor, as it is called, is controlled from the sewing-machine treadle. A light chain which runs from the control lever of the motor down through a hollow in the rear claw hook is arranged to be fastened around the back part of the treadle. When this chain is hooked up to proper length all that the operator has to do to start, stop and otherwise control the speed of the machine is to vary the pressure of the foot upon the treadle. Any speed of operation between one stitch per minute and 800 stitches per minute can be easily secured, it is pointed out, by simply pressing the treadle until the machine is driven at the required speed.

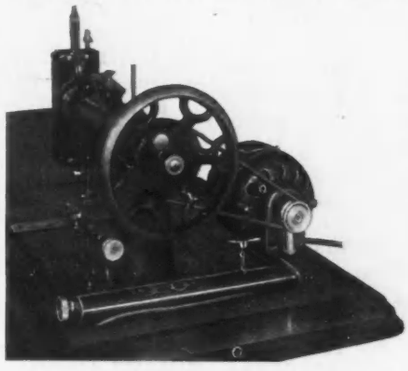


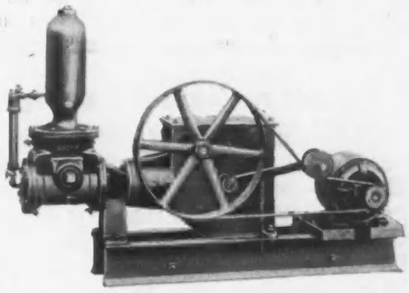
FIG. 2—MOTOR IN PLACE ON SEWING MACHINE

When pressure of the foot is removed, the machine is stopped instantly.

The motor is so designed that it will not become overheated and burn out. An automatic switch within the motor opens the electrical circuit when the pressure is removed from the sewing-machine treadle. "Modista" motors are designed for use on circuits of standard voltages and frequencies generally used with incandescent lamps. The weight of the motor complete is 8.5 lb.

Shallow-Well Pumping Outfit

The motor-driven pump shown herewith is designed especially to meet the water-supply requirements for bathroom, kitchen and laundry purposes in residences, in suburban districts not reached by city water mains or where the city or artesian water is hard or otherwise undesirable for household use. The outfit is designed to operate quietly and requires little attention. The working parts of the pump are inclosed in a dust-proof case and operate in an oil bath, insuring minimum wear and quiet operation. An air chamber is provided in the discharge line of the pump to prevent "pounding" in the lines, thus insuring against the bursting or loosening of pipe joints. The pump is operated by a Westinghouse motor belted to the pump pulley and mounted on channel irons together



MOTOR-DRIVEN HOUSE PUMP

with the pump so that no special foundations are required. The pump is being manufactured by the Leader Iron Works, Decatur, Ill.

Sensitive Motor-Driven Drill

A small, high-speed, sensitive drill, especially adapted for working on small parts, has just been brought out by the Wisconsin Electric Company, Racine, Wis. The drill is direct connected to the motor, as shown in the accompanying illustration, and is equipped with a 13/64-in. Jacobs chuck. It is designed to drill holes in steel with diameters up to 3/32 in., and in brass, aluminum and wood with diameters up to 13/64 in. The drill is equipped with SKF ball bearings, and is extremely sensitive, the manufacturer points out, owing to the special coil spring mechanism

BENCH DRILL WITH MOTOR DIRECTLY CONNECTED TO TOOL

mounted in the column. It is 18 in. high and has a stroke of 2 in. The motor and bracket can be readily raised or lowered on the main column. The motor overhangs sufficiently to enable the operator to drill in the center of a 6-in. circle.

NEWS OF THE INDUSTRY

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

Western Electric Earnings $63,852,000

The annual report of the Western Electric Company, Inc., which is in effect a reorganization of the Western Electric Company of Illinois, covers the operations of both the Illinois and the New York companies during the year 1915, thus giving the results of the continuing business without attempting to segregate that part which pertains only to the operations of the new company.

The sales for 1915, the report states, were $63,852,000, as compared with $66,408,000 for 1914 and $77,533,000 for 1913.

"During the latter part of the year, however," says President H. B. Thayer, "there was an increasing demand for our products, and the present prospects indicate a fair volume of business in 1916, following the general business activity of the country.

"The costs of our raw material have been very much inflated by the demand for similar material by manufacturers of war munitions or by interrupted supplies of such as usually come from abroad, which continually reminds us that the general business activity is largely founded upon the abnormal conditions abroad. These higher costs materially affect the costs of our manufactures, and when the return to normal conditions comes we may expect a considerable shrinkage in the value of such materials as we may have in stock at that time."

The orders on hand, the report goes on to say, on Jan. 1, 1916, were $2,111,000 in value more than on Jan. 1, 1915. The average value of an order filled during 1915 was $55, as compared with $56 for 1914. The number of employees on Jan. 1, 1916, was 17,135, as compared with 15,650 on Jan. 1, 1915. The earnings of the company for the twelve months ended Dec. 31, 1915, follow:

Sales		$63,852,469
Other income		1,147,961
		$65,000,430
Cost of merchandise	$54,795,525	
Expenses	5,419,875	
Taxes	518,253	
Appropriated for:		
Reserve for contingencies	650,000	
		61,383,653
Available for interest and dividends		$3,616,777
Interest paid	$789,664	
Dividends	1,609,500	
Carried to surplus	1,217,613	
		$3,616,777

New 22,000-Kw. Plant for New Bedford

While the details have not as yet been worked out, it has been decided by the New Bedford (Mass.) Gas & Edison Light Company to erect a new generating plant having an initial rating of 22,000 kw., with room left to add another 10,000-kw. or 15,000-kw. unit. The approximate cost of the new station is placed at $1,250,000.

The decision to build was reached quickly when the company received contracts last January for an additional power load of something like 9000 hp. This brought the peak load on the system up to approximately 15,000 kw. Of this 9000 hp., the Manomet Mill contracted for 5000 hp., the Sharp Manufacturing Company for approximately 2500 hp., and the remainder was contracted for smaller amounts from a number of industrial concerns.

The latest statement from the company showed its present station to be equipped with four alternating-current generators with a total rating of 10,000 kw. and eight direct-current generators with a total rating of 1500 kw.

Standard Gas and Electric Annual Report Shows Progress

In his annual report to the shareholders of the Standard Gas & Electric Company for 1915 President H. M. Byllesby shows that the company has made substantial progress during the year, while at the same time permitting subsidiaries to reinvest a large amount, $1,322,792, in the properties through depreciation reserves and undistributed surplus.

Earnings, after the payment of fixed charges, amounted to 6.3 per cent on the preferred stock, upon which dividends were paid at the rate of 4 per cent, leaving a surplus for the year of $270,979. Compared with the previous year the 1915 earnings statement is as follows:

	1915	1914
Gross earnings	$1,618,467	$1,475,029
Net earnings	$1,575,441	$1,435,418
Balance for dividends	$742,377	$619,964
Dividends	$471,398	$785,663
Surplus	$270,979	.....
Deficit	.....	$165,699

President Byllesby says in the report:

"The amounts retained by some of the subsidiary companies for surplus purposes are proportionately greater than need be in coming years, and it is therefore reasonable to expect at an early date an increase in your company's collectable income from that source.

"In general, the operations in the past twelve months have demonstrated that the income of the Standard Gas & Electric Company will steadily improve, and we are firmly of the belief that the returns for the year 1916 will be largely in excess of those for 1915, which were gratifying under the existing circumstances. With the increased earnings indicated, we have no hesitancy in repeating the statement made in the last report that the income of the company will, in time, rise to a point which will be far more than sufficient to provide for the normal 8 per cent dividend in cash upon the preferred stock.

"The balance sheet and earning statements given in the report in detail fully set forth the condition of the company. We desire, however, to call attention to the excellent financial condition reflected in a freedom from floating debt of every description and to the fact that your company has, in the form of cash on hand and deferred payments on sales of twenty-year gold notes. ample funds to retire the remaining balance of its collateral trust notes, which mature on June 1, 1916, and, in addition, to provide a substantial working balance.

"Upon the success of the financing of the company by twenty-year, 6 per cent gold notes, and in accordance with the promise made in the circular to shareholders, cash dividends at the rate of 1 per cent per quarter were commenced on Dec. 15, 1915. The policy of the company will be to maintain the present rate for some months, but with the expected increase in earnings it is hoped that the dividend rate will be increased from time to time until the preferred stock reaches its full 8 per cent."

Gross earnings in 1915, of the companies in which the Standard Gas & Electric Company owns securities, were $15,539,281 and net earnings, $7,585,602. Expenditures for improvements amounted to $3,738,217. Taxes paid aggregated $1,031,550, or 13.6 per cent of the gross income.

The total number of customers served by subsidiaries advanced from 308,378 to 325,153, and the estimated population of all the communities served is given as 1,808,221. While there was a decrease in the number of gas and water customers, and but slight increases in steam and telephone customers, the number of electric customers increased during the year from 169,412 to 188,623.

Public Service Commission News

West Virginia Commission

Rules and regulations covering the construction and filing of rate schedules in the State of West Virginia by electric, telephone, telegraph, gas, water and other public utilities except railroads will be made effective in April. Utilities operating wholly or partly in the State are required to file with the Public Service Commission schedules showing all their rates and other charges, and to have all books open to the public for examination.

Pennsylvania Commission

The Ambridge Light Company was ordered by the Pennsylvania Public Service Commission to cease operating until it had obtained a certificate of public convenience, the commission holding that a public service corporation cannot exercise its power or franchise until after it has received a certificate of public convenience, where its charter was not recorded until after the effective date of the statute requiring the certificate, although letters patent were issued before that time.

Maryland Commission

In the investigation of the rates and charges, property and affairs of the Chesapeake & Potomac Telephone Company of Baltimore City, the Public Service Commission of Maryland concluded that the fair value for rate-making purposes of the property of the company in the State of Maryland was $11,554,758, and that the net income from operations for distribution during the year ended June 30, 1914, was $673,240, the same being at the rate of 5.82 per cent upon the investment as shown above, or at the rate of approximately 6 per cent upon the average investment for the year ended June 30, 1914. The maximum return which the company should be permitted to earn upon its property used in the public service in the State was held by the commission to be 8 per cent.

Montana Commission

In an investigation of the rates of the Montana Power Company to consumers in the city of Philipsburg, the Montana Public Service Commission held that rates may be investigated without a physical valuation of a plant operated without profit, since the only object of a valuation is to determine whether profits are excessive. A minimum rate to small electric light consumers in excess of $2 a month less a discount of 10 per cent for prompt payment was held to be excessive, and the acceptance of payment for electric lighting in disregard of or without meter readings discriminates against customers paying in accordance therewith. The commission held that the collection of a minimum charge for electric lighting less than the rate filed with the commission is unlawful. An annual depreciation allowance of 5 per cent for a small electric light plant was held to be proper. It was further held that uncollected electric light bills amounting to 12 per cent of the total charges were excessive.

Connecticut Commission

After hearing the petition of residents of Maple Hill in the town of Newington, alleging failure or refusal of the New Britain Gas Light Company to extend its mains and furnish service to these people, the Connecticut Public Utilities Commission held that a utility is presumed to anticipate the obligation to make reasonable extensions that may not be immediately profitable in entering territory by securing a charter right. A utility may be required to make an extension that will not be immediately profitable if the prospects of future business are reasonably good. As a protection in part against loss in the early years of extension that yields an income small in proportion to the cost of the installation, a utility is justified in exacting a moderate annual minimum charge. Although the expense will be out of proportion to the immediate return, the company was required to extend its mains into territory where it has secured charter rights to serve, where the extension will ultimately be profitable and the exaction of a minimum charge will reduce the losses incurred during the early period of operation.

Maine Commission

With the approach of summer the question of rates for service during the summer alone again assumes importance. The Maine Public Utilities Commission has put itself on record as to the reasonableness of higher unit rates in the case of Calcord et al. versus the Searsport Water Company. The commission in its decision states: "So far as it costs more to serve the twelve-month taker, he should, of course, pay more. But such items as are not modified by the length of time of actual use may, and should, properly be distributed among all of the users whom the public utility must stand ready to serve. The water plant, the electric plant, the gas plant—each is constructed at one of these places capable of supplying the demand during the period of seasonal use. The capital invested, the depreciation, the normal maintenance, insurance, all of those charges which go on whether a greater or lesser amount of product is being consumed, are required as much for the premises which are regularly occupied duing some part of each year, and must be served when occupied, as for those premises which are open and supplied throughout the year. It is the 'readiness to serve' element."

In granting authority to the Central Maine Power Company to acquire the Penobscot Bay Electric Company, as reported in the ELECTRICAL WORLD, the Maine Public Utilities Commission held that a consolidation of electric companies operating nine out of the sixteen counties of the State would be authorized where the purchasing company was using less than one-half its power capacity and had much unused water power, while the companies to be acquired had not sufficient water power to generate a supply for their territory, and the utilities act was adequate to secure for the public its share of the resulting benefits.

University of Texas to Offer Summer Course to Electricians.—The School of Electrical Engineering of the University of Texas will offer a short summer course for practical electricians, according to present plans.

St. Louis Gets 25,000-Kw. Turbo Set.—A new 25,000-kw. turbine set has been installed at the Union Electric Light & Power Company's plant. The new set, which is said by company officials to be the most powerful one west of the Mississippi, replaces a 10,000-kw. set.

Rates for Grain Elevators.—The Indiana Public Service Commission has authorized the Citizens' Heat, Light & Power Company of Winchester, Ind., to install a new schedule of rates for power, for use in grain elevators in the town of Ridgeville, ranging from 7 cents to 1.5 cents per kilowatt-hour.

Seattle Auxiliary Plant to Be Enlarged.—Plans have been outlined by the municipal lighting department of Seattle, Wash., for the construction of an addition to the Lake Union steam auxiliary plant. The additional unit, as planned, will have a capacity of 13,000 hp. and it is estimated will cost $250,000.

O. C. Barber Proposes to Sell Energy to City of Cleveland, Ohio.—At a conference between Light and Heat Commissioner Davis and O. C. Barber on March 20 Mr. Barber's plan of building a central station near a coal mine within 100 miles of Cleveland and furnishing energy to the city for distribution on the municipal plan was discussed. Mr. Barber proposes to produce and transmit energy to the city limits, while the city would take care of the distribution to customers. The plant would probably be located in the Massillon coal district.

Oklahoma Dealers Meet Success with Monthly Payment Plan.—A campaign to sell electric vacuum cleaners on a monthly payment basis was conducted by the electrical dealers of Oklahoma City in co-operation with the Oklahoma Gas & Electric Company during February, resulting in the sale of seventy-two of these devices. The success of this effort has encouraged the appliance dealers to continue the campaign with the anticipation of selling at least fifty vacuum cleaners monthly. A similar campaign conducted in El Reno during the month resulted in the sale of forty-three cleaners.

City Asks for Forfeiture of Franchise Because of Non-Use.—The Board of Estimate of New York City has instructed the corporation counsel to petition the attorney-general of the State to institute an action to forfeit the franchise of the Amsterdam Light, Heat & Power Company, on the grounds that the franchise had not been used in the period prescribed in its charter. The Amsterdam company is a subsidiary of the Edison Electric Illuminating Company of Brooklyn, and the present action is the result of the long-drawn-out dispute between the Brooklyn company and the city as to its rights to operate in certain parts of the borough.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

To Start Work on New $3,000,000 Hydroelectric Plant for Northwest This Summer.—It is persistently rumored that the Great Northern Railway Company is making preparations to begin work this summer on the construction of its proposed huge hydroelectric power plant at Lake Chelan, Washington. The proposed improvement, it is reported, will involve an expenditure of more than $3,000,000.

Detroit Engineers to Hear Military Engineering Lectures.—A course of lectures on military engineering will be given by Col. M. M. Patrick and Maj. P. S. Bond, corps of engineers, U. S. A., in Detroit every Wednesday evening, beginning with March 29 and continuing to April 26. The object of the course is to point out to men of engineering training or experience the ways they may best serve the country in time of need and will also directly assist those intending to enter the engineering battalion at Plattsburgh this summer.

Power Company Defeats City in Water Power Case.—The decision of the United States Supreme Court in the fight between the city of Akron, Ohio, and the Cuyahoga River Power Company resulted in a victory for the company, asserting the company's right to restrain the city from appropriating water from the river in such a manner as to make the projected power development impossible. The company appealed from the dcision of a federal court two years ago to the effect that no federal question was involved, and was successful in the upper court.

Ohio Utilities Must File Valuations.—Attorney-General Turner of Ohio has upheld the right of the Public Utilities Commission to require Ohio utilities to file inventories and valuations of their property, regardless of whether any question of rates is pending. Under this opinion, about half of the utilities in the State, it is said, which have not complied with the commission's order of March 19, 1914, for the filing of their inventories must do so immediately. Several have threatened to contest the validity of the commission's requirements and of the law under which the action was taken. The question arose over the Toledo Railways & Light Company's case in which several extensions of time have already been granted, after which the company finally challenged the right of the commission to enforce its order. The attorney-general declares that if the city's desire for the inventory is based on the question of buying the railway property, the commission is authorized to make the appraisal.

New Trunk Line into Eastern Texas.—A high-powered transmission line through Dallas County has been announced by the Texas Power & Light Company. At Forney the line will "tie up" with a like high-voltage line between Kaufman and Terrell, making an entirely new trunk line into eastern Texas for the company.

Penn Central Gets 4100-hp. Contract.—The Penn Central Light & Power Company of Altoona, Pa., has secured a contract for supplying power to the Burnham plant of the Standard Steel Company near Lewistown, Pa. The steel company recently decided to purchase power instead of supplying its own energy, as it has done heretofore. The contract calls for 4100 hp.

Energy Consumption for Electric Iron Ore Smelting.—The energy consumption of an Elektrometall furnace, to produce one ton of pig iron, according to an investigation made of the electric iron ore smelting industry of the Scandinavian countries by the Canadian department of mines, is 0.41 hp.-yr. for 60 per cent ores and 0.47 hp.-yr. for 50 per cent ores. These figures are for both basic Bessemer and acid open-hearth iron. To make gray foundry pig iron about 0.5 hp.-yr. is required. The average consumption of electrodes is 5 kg. to 6 kg. per ton of iron. This consumption varies considerably and has been reduced as low as 3 kg.

Utah and Nevada Demonstration Train to Exploit Electricity.—Utah and Nevada will combine efforts this year in operating an elaborate demonstration train to spread education among the people of the West. One of the principal features of the train's operation will be the innovation of practical demonstrations in the latest types of labor-saving machinery for use both on the ranch and in the home. Electricity will be given special prominence and an entire car will be occupied with appliances operated by electric power. The appliances will include everything for the modernizing of the home, and will show the people what strides have been made in the use of electricity as an adjunct to home economics.

Railroad Company Not Allowed to Sell Power.—In an opinion recently handed down by Judge Strauss of Wilkes-Barre, Pa., the preliminary injunction granted the Citizens' Electric Illuminating Company against the Lackawanna & Wyoming Valley Railroad Company, restraining the latter from selling and supplying electricity in Pittston and vicinity, it was stated that the railroad company under its present charter as a railroad has no right to embark in the electrical business. The opinion states: "The defendant being an incorporated company doing business as a common carrier is within the prohibition of Act 17, Sec. 5 of the constitution, which declares that such company shall not directly or indirectly engage in any other business than that of common carrier, because the sale of electricity produced at the plant of the defendant is a direct engagement in another business than that of a common carrier."

Schenectady Section, A. I. E. E.—The 172nd meeting of the Schenectady section of the American Institute of Electrical Engineers was held on March 21. Dr. Albert C. Crehore presented a paper entitled "Atoms and Molecules."

Newark Jovian League.—Captain Parrott of the Edison Lamp Works of the General Electric Company, addressed the Newark Jovian League at the regular luncheon on March 16 on the topic of "Electricity and Its Uses in Japan."

Detroit Engineering Society.—The next meeting of the Detroit Engineering Society will be held April 7 at the society's hall. Prof. D. C. Jackson, of the Massachusetts Institute of Technology, will speak on "High Power Traction."

New York Jovian League.—T. C. Martin, secretary of the National Electric Light Association, spoke at the regular meeting and luncheon of the Jovian League of New York City on March 29 on the topic "Electric Vistas and Outlooks."

Jovian Chapter Cleveland Electrical League.—Victor T. Noonan, safety director of the Industrial Commission of the State of Ohio, addressed the Jovian Chapter of the Cleveland Electrical League on March 9 on the "safety-first" movement.

Philadelphia Section, A. I. E. E.—Prof. Charles F. Scott of Yale University addressed the members of the Philadelphia section of the American Institute of Electrical Engineers on March 17 on the subject of "Engineering Training as a Business Asset."

Arkansas Association of Public Utility Operators.—It is announced that the annual convention of the Arkansas Association of Public Utility Operators formerly scheduled to be held at Little Rock, Ark., on May 9, 10 and 11, has been postponed until June 6, 7 and 8.

Pittsburgh Sections, A. I. E. E. and I. E. S.—A joint meeting of the Pittsburgh Sections of the American Institute of Electrical Engineers and of the Illuminating Engineering Society was held on March 14. W. R. Woodward read a paper on "Constant Current Systems for Street Lighting."

Worcester Polytechnic Institute Branch, A. I. E. E.—The fifth regular meeting of the Worcester Polytechnic Institute branch of the American Institute of Electrical Engineers was held on March 17. William R. Bell, chief load dispatcher of the Connecticut River Transmission Company system, gave an address on that system.

Lynn Section, A. I. E. E.—The Lynn Section of the American Institute of Electrical Engineers had as its guests members of the New England Section, Illuminating Engineering Society, at a meeting on March 8, when a paper on "Light, Shade and Color in Illumination" was presented by M. Luckiesh, Nela Park Laboratory, Cleveland, Ohio.

Yale Branch, A. I. E. E.—Courtland W. Babcock, commercial industrial engineer of the Westinghouse Electric & Manufacturing Company, discussed at a meeting of the Yale branch of the American Institute of Electrical Engineers on March 3 the characteristics and advantages of different kinds of power as affecting methods, output and economies in industrial establishments.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 799 of this number.

San Francisco Section, A. I. E. E.—A meeting of the San Francisco Section of the American Institute of Electrical Engineers was held at the Engineers' Club on March 31. The subject of the evening was "Transmission Line and Insulator Losses at Extremely High Voltages," by Prof. Harris J. Ryan of Leland Stanford University. Professor Ryan's paper was illustrated with lantern slides.

Pennsylvania Section, N. E. L. A.—Harrisburg has been selected as the permanent headquarters of the southern branch of the Pennsylvania section of the National Electric Light Association. C. M. Kaltwasser, general manager of the Harrisburg Light & Power Company, has been elected president, and H. M. Stine, secretary of the Pennsylvania Railways Association, has been elected secretary.

Hotel List for N. E. L. A. Convention.—The hotel committee of the National Electric Light Association has compiled and sent to members a list of the principal hotels available to those attending the annual convention in Chicago from May 22 to May 26. The compilation includes a map which shows the location of the various hotels with reference to the convention headquarters. Reservations will be made by the committee for those who desire them.

South Hudson Electrical Contractors' Association.—Preliminary plans for the organization of the South Hudson Electrical Contractors' Association were formulated at a meeting held in Jersey City on March 17. The next meeting of the association was held on March 21. This association, which plans to extend co-operation between all electrical contractors in the southern part of Hudson County of New Jersey, has adopted the name of South Hudson Electrical Contractors' Association.

Detroit Contractors Elect Officers.—The Detroit Electrical Contractors' Association held its fourth annual banquet at the Hotel Cadillac on March 18. Officers were elected as follows: Charles W. Hanes, of Hanes-Hough Company, president; Henry F. Pappert, of the Union Electrical Construction Company, vice-president; Bruce Palmer, of Palmer Electric Company, secretary, and W. D. Gale, of W. D. Gale., Inc., treasurer.

New York Electrical Society.—The 345th meeting of the New York Electrical Society was held in the Engineering Societies Building on March 24. Frank J. Sprague, past president of the society, gave an address on "A Month with the Atlantic Fleet During Battle Maneuvers, Drills and Target Practice." This trip was undertaken by Mr. Sprague, who is a member of the Naval Consulting Board and an ex-officer of the United States Navy, for the purpose of getting first-hand impressions of the present condition of the fleet, with a view to preparedness in case of emergencies.

Kansas City Section A. I. E. E.—A section of the American Institute of Electrical Engineers is to be established at Kansas City, Mo., including such cities in the 60-mile radius as St. Joseph, Lawrence, Leavenworth and Excelsior Springs. There are thirty-five members of the institute in Kansas City, and at least twelve elsewhere in the district. Gordon Weaver, power sales manager of the Kansas City Light & Power Company, has received signatures to the petition, which is now being considered. This will be the first section of a national engineering association to be established in Kansas City, though the "civils" have sufficient members, and are making plans to organize.

New Haven Section, A. I. E. E.—A joint meeting of the New Haven Sections of the civil, electrical and mining engineering societies will be held on April 5 instead of April 15, as announced in our issue of March 18. At the afternoon session H. I. Harriman of Boston will present an illustrated paper on "The Water Powers of New England" and a general discussion on the topic "The Power Requirements of Connecticut Industries" will be opened by R. J. S. Pigott of Bridgeport, Conn., and F. R. Low, editor of *Power*. In the evening Samuel Insull, president of the Commonwealth Edison Company, Chicago, will give an illustrated address on "The Progress of Economic Power Generation and Distribution."

New-Business Committee, Indiana Electric Light Association.—The first convention of the new-business committee of the Indiana Electric Light Association will be held on April 19 at the Kokomo Elks Club, Kokomo, Ind. Program: Address of welcome, E. J. Condon, president of the association, Indiana Utilities Company, Angola, Ind.; "Electric Cooking," by Pierre L. Miles, Kokomo, Ind., sales manager electrical department, Globe Stove & Range Company; discussion, Norman A. Perry, Indianapolis, Ind.; M. V. Stagg, Fort Wayne, Ind.; H. E. Gant, Marion, Ind.; talk by Mr. Elwood Haynes, "Tungsten and Its Application to the Electrical Industry," by Elwood Haynes; "Facts and Figures on Rural Extensions," by P. H. Palmer, Indiana Railways & Light Company, Kokomo, Ind.; discussion, E. I. Myers, Fort Wayne, Ind.; G. K. Wilson, Muncie, Ind.; John Kester, Noblesville, Ind.; "Forecast and Co-operation," by R. A. McGregor and read by A. C. Riggs, both of the Merchants Heat & Light Company, Indianapolis, Ind.; discussion, G. O. Nicolai, Terre Haute, Ind.; Thomas Donahue, Lafayette, Ind.

FINANCE, COMMERCE AND INDUSTRY

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Manufacturing and Industrial

Copper Market Situation

The National Conduit & Cable Company of New York, in discussing the present situation in the copper market, expresses the belief that the present high prices will not continue indefinitely. The company says:

"All the large mills of the country are operating their plants at an abnormal rate. This fact in itself indicates that the present expansion in manufacturing demand is extraordinary and extreme. It is therefore reasonable to expect that the era of inflated prices cannot continue indefinitely, and that the future course of the copper market will depend on the developments affecting trade when more normal conditions are restored in the business world.

"Market values are now on a basis calculated to instill the utmost caution in the minds of every conservative manufacturer. The conclusion of the great European war must eventually bring about a readjustment of values and industrial conditions. The European situation has been the great factor in the expansion of demand for copper. Conditions developed by a great war have converted multiplied industrial plants into vast munition factories. Further important requirements are highly probable which may keep present high prices in force for some time. But while it is admitted that the market at present has the support of an enormous demand, it is needless to say production is also expected to reach the highest record in the history of the trade. The maximum in output is not yet reached and productive facilities are expected to show a substantial increase during 1916.

"With copper selling at double the price it brought early in 1915 there is every inducement to stimulate production. All the principal producing districts are busy preparing to eclipse all previous performances. New methods and improvements in metallurgical practice have resulted in reducing previous heavy losses, and it is evident that more copper will be available for consumption. There has also been a notable increase in refinery capacity at plants located in the West and on the Atlantic Coast. The extensive expansion accomplished in electrolytic refining capacity will greatly increase the annual output of commercial copper in the United States. Former high levels of production will be exceeded when recent important changes go into full operation. The ability to turn out copper in marketable form will be lifted to a new basis, and under the latest modern conditions consumption will be forced to submit to a new test as to its power of absorption. There was renewal of buying interest within the last few days. Inquiries were increasing and the tone of the market was firm based on improved domestic demand. March and April Electrolytic were quoted 27½ @ 28c."

The French Battery & Carbon Company of Madison, Wis., has just established a factory branch and warehouse at Dallas, Tex., which will be under the management of A. I. Folsom.

The Electric Storage Battery Company, Philadelphia, Pa., has moved its St. Louis office from the Fullerton Building to 1508 Federal Reserve Bank Building. This change has been necessitated on account of increase in business in the St. Louis territory, larger quarters being required.

Engberg's Electric & Mechanical Works, St. Joseph, Mich., manufacturers of dynamos, engines, searchlamps, etc., have opened branch offices at 39 Cortlandt Street, New York, with D. J. Rowland as manager; Fisher Building, Chicago, with F. H. Pond as manager, and Wells Building, Milwaukee, Wis., with F. H. Dorner as manager. D. D. Merrill, secretary of the company, states that the opening of these offices has been necessitated on account of the increased demand for the company's apparatus in the territories named.

Revisions in Standards for Rubber-Covered Wires.—The Underwriters' Laboratories, Chicago, have just issued a number of revised pages for the June, 1915, edition of their Standards for Rubber-Covered Wires and Cables, presenting, in italics, the substance of the various actions taken by the Industry Conference for Rubber-Covered Wires and Cords, held in January of the present year. The new pages on which revisions appear number twelve in all, and refer to test conditions for measuring insulation resistance; the determination of tensile strength of rubber; room temperatures at time of test; lay of conductors in twisted pairs for cables, etc. A micrometer microscope for measuring insulation thickness, cross-section areas, etc., is also illustrated and described.

Special Agent to Investigate Market for Electrical Goods in South America.—Stanley H. Rose, commercial agent in charge of the New York office of the Bureau of Foreign and Domestic Commerce, announces that Philip S. Smith has been appointed special agent of the bureau to investigate the markets for electrical goods in South America. Mr. Smith will report both on the present conditions as well as the future prospects in the South American market for electrical goods of all character. His reports, it is stated, will enable the American manufacturer to cultivate intelligently the South American market. At the present time Mr. Smith is visiting a number of American cities with the purpose of interviewing American manufacturers and to ascertain what ground American firms interested in foreign trade would like to have Mr. Smith cover in his investigation. Mr. Smith expects to be in New York (Room 409, Custom House) from April 24 to April 27, and will be very glad, it is announced, to meet American manufacturers and exporters of electrical apparatus and supplies. Interested parties may make appointments with Mr. Smith by addressing Stanley H. Rose, commercial agent in charge, bureau of foreign and domestic commerce, 409 Custom House, New York.

Recent Orders for Gas Engines.—Following are some of the orders for gas engines recently booked by the Bruce-Macbeth Engine Company, 2122 Center Street, Cleveland, Ohio: The Gem Clay Forming Company, Sebring, Ohio, one 40-hp. natural-gas engine; Lee Graber, Massillon, Ohio, one 40-hp. natural-gas engine; the Hayes File Company, Detroit, Mich., one 40-hp. artificial-gas engine; the Cross Gear & Engine Company, Detroit, Mich., one 60-hp. artificial-gas engine; the Wood & Spencer Company, Cleveland, one 70-hp. natural-gas engine (second order); the Commercial Auto Body & Manufacturing Company, Cleveland, one 90-hp. natural-gas engine; the Atlantic Foundry Company, Akron, Ohio, one 125-hp. natural-gas engine (repeat order); the American Window Glass Company, Belle Vernon, Pa., one 150-hp. natural-gas engine; the Universal Rolling Mill Company, Bridgeville, Pa., one 150-hp. natural-gas engine (third order); the American Well & Prospecting Company, Corsicana, Tex., one 150-hp. natural-gas engine; George W. Wood, Birmingham, Mich., one 35-hp. twin-cylinder producer-gas engine; the Turner & Moore Manufacturing Company, Detroit, Mich., one 150-hp. four-cylinder artificial-gas engine; the Wheats Ice Cream Company, Akron, N. Y., one 60-hp. twin-cylinder natural-gas engine (eighth engine order); the Budd Dairy Company, Columbus, Ohio, one 150-hp. four-cylinder natural-gas engine; the Bickett Machine & Manufacturing Company, Cincinnati, one 90-hp. four-cylinder natural-gas engine.

The Manistee Iron Works Company, Manistee, Mich., has opened a new office at 50 Church Street, New York. This office will be under the direction of R. M. Klein, district manager.

The Ames Iron Works, Oswego, N. Y., have appointed Walter Castanedo district manager of their New Orleans office, as already noted in the March 25 issue of the ELECTRICAL WORLD, with headquarters at 1101 Hennen Building instead of at 1103 Hennen Building, as noted in the previous issue.

Hurley Machine Company.—F. W. Buck, who for the last eight years has been connected with the Union Electric Company of Pittsburgh, Pa., as advertising manager and purchasing agent and in other capacities, has resigned as advertising manager of that company, and will hereafter represent the Hurley Machine Company of Chicago in the Pittsburgh territory.

Orders for Large-Sized Turbines.—The I. P. Morris Company, Philadelphia, Pa., has just received an order from the Rochester Railway & Light Company, Rochester, N. Y., for two 16,000-hp. turbines of the vertical-shaft, single-runner type, designed to operate under a head of 130 ft. at a speed of 180 r.p.m. These turbines will be controlled by I. P. Morris governors.

The Franklin Railway Supply Company, 30 Church Street, New York, has appointed Ralph G. Coburn sales manager of its electrical department. Mr. Coburn has been associated with the Franklin company for the past seven years, being formerly in charge of its Chicago office and for the last few years Eastern sales manager, with headquarters in New York, where he will continue in his new position.

General Electric Factory for Providence.—A new factory for the production of lamp bases will be built by the General Electric Company at once at Atwell and Harris Avenues, Providence, R. I. A modern power plant is planned, and about 600 persons are to be employed. The factory will be ready for occupancy by fall and will supplement the work now performed at the Providence Base Works on Hospital Street.

The Carroll Electric Company, jobber of electrical supplies and machinery, Washington, D. C., has moved its offices, retail store and warehouse to its new building at 714 Twelfth Street Northwest, Washington, D. C. The new retail supply store is complete in its appointments, and represents in equipment the result of years of experience in the electrical jobbing business. The company carries a complete stock of supplies, machinery and machine supplies, and does business throughout the South.

The Frank Adam Electric Company.—It was stated in the ELECTRICAL WORLD of March 18 that the Frank Adam Electric Company had changed its name to the Reflectolyte Company. This announcement is incorrect. The Reflectolyte Company, with offices at 914 Pine Street, St. Louis, Mo., has recently been formed to manufacture and distribute lighting fixtures designated as "Reflectolytes" under patents granted H. C. Adam. The Frank Adam Electric Company will continue to manufacture and distribute its "F. A." products.

The Electric Sales Engineers, Inc., 19 South Fifth Avenue, Chicago, announce that they have added to their other lines the "Connersville System" of stationary vacuum cleaners. This system uses the Connersville double-impeller involute pump manufactured by the Connersville (Ind.) Blower Company, and embraces a line of sizes ranging from ½ hp. for residences to the largest on the market. Grover McHugh, who has had many years' of experience with all types of vacuum cleaners, is associated with the Electric Sales Engineers, Inc., and has full charge of the vacuum cleaning department. His services in consultation are offered to architects and engineers on their cleaning problems.

Domestic Engineering Company to Make Small Isolated Plants.—A comprehensive outline of the field which the Domestic Engineering Company of Dayton, Ohio, intends to cover, is furnished by General Manager R. H. Grant. The company, he says, will manufacture a small electric plant, consisting of a gasoline engine direct-connected to a generator, for the use of farmers and others not accessible to central stations. He estimates that there are not less than 20,000,000 people so situated, and points out that in enabling them to have complete electric service for their homes and surroundings the company will be accomplishing a considerable advance in the development of the art. Incidentally, the company will market the various electric appliances now in general domestic use, both as an aid in securing the sale of the generating units and as a service to its customers who buy the generating plants.

New Prest-O-Lite Battery Plant.—A large addition is being made to the main factory of the Prest-O-Lite Co., Indianapolis, to accommodate the increased production of Prest-O-Lite storage batteries and is practically completed. The new building is 400 ft. long by 100 ft. wide and is provided with 40,000 sq. ft. of floor space; it is the second largest building of the present factory group. When this new addition is ready for operation the company will be able to produce 1200 batteries a day. The present output of batteries is 400 a day. Plenty of provision has been made for ultimate expansion. The building in general is one story in height with a monitor roof. There are, however, two rooms on the second floor each 50 ft. by 50 ft. in size, one of which will be used for a welfare room, containing shower baths, lockers and lunch rooms. The other will be used for shop office and laboratory.

Use of Metric System in Export Trade.—At the request of the Secretary of the Treasury a report on the use of the metric system in export trade has been prepared by Director S. W. Stratton of the National Bureau of Standards. This report was submitted at the last meeting of the International High Commission on Uniformity of Laws on Dec. 1, and was considered so complete and of such a useful character that the Hon. Duncan U. Fletcher, Senator from Florida, recommended it being issued as a Senate document. The document, printed in booklet form and consisting of eighty pages, should be of considerable interest to every manufacturer of machinery, machine tools and electrical supplies who is in touch or desires to get in touch with foreign markets. Firms desiring a copy of the booklet should send their request in writing addressed to Stanley H. Rose, commercial agent, 409 Custom House, New York City.

Large Motor Equipment for Steel Mills.—The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has recently sold to the National Tube Company the electrical equipment to drive a new 40-in. reversing rolling mill which it is about to install in its plant at Lorain, Ohio. This rolling mill, when completed, will be one of the largest, it is asserted, in the country. The reversing motor will develop 15,000 hp. and will run at a maximum speed of about 120 r.p.m. The power for the reversing motor will be supplied by a flywheel motor-generator set which will be so controlled that the load on the power plant will be limited to approximately 3000 kw. One of the novel features of this equipment is the arrangement made to allow the reversing motor to be turned over slowly for setting up the mill without running the flywheel motor-generator set. A sale of a similar equipment has been made to the Indiana Steel Company, which has purchased from the Westinghouse Electric & Manufacturing Company the electrical equipment to drive and control a new 40-in. reversing blooming mill, which is to be installed in its plant at Gary, Ind. The capacity of the reversing motor will be 15,000 hp. and it will be supplied with power by a flywheel motor-generator set. In addition to these two units the Westinghouse company is at present building the electrical equipment for four other reversing mills, two of which are approximately of the same size as those mentioned above.

Distribution of Electric Flags.—How interest in the electrically lighted American flag is spreading may be determined from the following list of towns where electric flags have been installed. Although the list is not complete, it shows in a remarkable way to what extent this new flag movement has been developed. Some of the towns to which flags have been sent and the number of flags sold are as follows: Toledo, 500; Massillon, Ohio, thirteen; Lincoln, Neb., thirteen; Athens, Ga., twelve; St. Joseph, Mo., twelve; Alliance, Ohio, ten; Galveston, Tex., twenty; Cleveland, Ohio, twelve; Sedalia, Mo., seven; Elyria, Ohio, six; Denver, Col., six; Salina, Kan., five; Joplin, Mo., five; Montgomery, Ala., four; Fremont, Neb., three; Bristol, Tenn., three;

Sanbury, Conn., three; Amarillo, Tex., two; Warren, Ohio, six; Hutchinson, Kan., one; Bartellsville, Okla., one; Durham, one; Dayton, Ohio, thirty; Lansing, Mich., three; Akron, Ohio, two; Meridian, Miss., one; Canton, Ohio, one; Oakland, Cal., one; Providence, R. I., one; Chicago, ten; Port Huron, one; Boston, two; Knoxville, Tenn., ten; Litchfield, one; New York City, four; Jersey City, ten; Topeka, Kan., one; Hot Springs, Ark., one. The following list of towns have one to five signs: Albany, N. Y.; Steubensville, Ohio; Cincinnati, Ohio; Louisville, Ky.; Detroit, Mich.; Port Huron, Mich.; Lansing, Mich.; Grand Rapids, Mich.; Orion, Mich.; Benton Harbor, Mich.; Niles, Mich.; Battle Creek, Mich.; Marquette, Mich.; Newark, Ohio; Tiffin, Ohio; Sandusky, Ohio; Norwalk, Ohio; Martinsville, Ind.; Vincennes, Ind.; Bannersville, Ind.; Shelbyville, Ind.; Mishawaka, Ind.; Gary, Ind.; Valparaiso, Ind.; Huntington, Ind.; Marion, Ind.; Portland, Ind.; Muncie, Ind.; Anderson, Ind.; Elwood, Ind.; Terre Haute, Ind.; Crawfordsville, Ind.; New Castle, Pa.; Sharon, Pa.; Gery, Pa.; Allentown, Pa.

NEW YORK METAL MARKET PRICES

	March 21 Selling Prices Bid	Asked	March 28 Selling Prices Bid	Asked
Coppper	£ s d		£ s d	
London, standard spot	112 5 0		113 0 0	
Prime Lake	27.37½ to	27.62½†	26.87½ to	27.12½†
Electrolytic	27.37½ to	27.62½†	26.87½ to	27.12½†
Casting	27.75 to	26.25†	25.50 to	25.75†
Copper wire base	29.00 to	29.50†	28.25 to	28.75†
Lead	7.00		7.00	
Nickel	45.00 to	50.00	45.00 to	50.00
Sheet zinc, f.o.b. smelter	25.00†		25.00†	
Spelter	17.67½ to	17.92½†	17.67½ to	17.80†
Tin, straits	50.00†		50.00†	
Aluminum, 98 to 99 per cent	57.00 to	59.00†	57.00 to	59.00†

OLD METALS

Heavy copper and wire	21.00	to 21.50†	21.00	to 21.50†
Brass, heavy	13.50	to 14.00†	13.50	to 14.00†
Brass, light	11.00	to 11.50†	11.00	to 11.50†
Lead, heavy	6.25	to 6.50†	6.50	to 6.62½†
Zinc, new scrap	15.50	to 16.00†	15.50	to 16.00†

COPPER EXPORTS

Total tons to March 28 20,873

†Nominal.

Corporate and Financial

Detroit (Mich.) Edison Company.—The condensed income account for 1915 compared with 1914 follows:

	1915	1914
Gross revenue	$7,759,932	$6,495,814
Expenses (total)	$4,811,219	$4,194,751
Operating and non-operating expenses, including maintenance and taxes	4,211,219	3,674,750
Renewal, replacement and contingency (depreciation reserve credit)	$600,000*	$520,000
Net income	$2,948,713	$2,301,063
Interest on funded and unfunded debt	1,100,055	882,312
Net	$1,848,658	$1,418,751

*The $600,000 credit to depreciation reserve, included as an item of expense, is additional to ordinary maintenance expenditures, which amounted to $456,667.

Electric Storage Battery Company, Philadelphia, Pa.—The staement of earnings of the company for the year ended Dec. 31, 1915, follows:

Gross sales, less cost of manufacture and purchases and all expenses incident thereto	$1,770,188
Operating expenses, including salaries, commissions, engineering, selling and traveling expenses and rent of branch offices	581,570
Net earnings from sales	$1,188,618
Other income	172,130
Total net earnings	$1,360,748
Less dividends paid during year	649,964
Net earnings for 1915 after paying dividends	$710,784

Interstate Public Service Company, Indianapolis, Ind.—The Indiana commission has granted authority to the company to issue $24,000 of bonds to sell at not less than 80, the proceeds to be used for reimbursing the company's treasury for extensions at several Indiana towns and cities and to refund a small bond issue.

Montana Power Company, Butte, Mont.—The depressed condition of business prevailing during the latter part of 1914 continued during the early part of 1915, but beginning in May the company's earnings showed gradually increasing gains over the corresponding months of the previous year, it was stated in the annual report for 1915. The earnings in December reached the highest point in the history of the company. The increases in earnings for the year 1915 over 1914 were 15.38 per cent in the gross and 25 per cent in the net, which increases were due partly to the resumption of mining operations to full capacity during the latter part of the year, and to a greater extent to a marked improvement in the growth of the company's general business. Service of power to the Chicago, Milwaukee & St. Paul Railway Company was begun over a part of the line in December, but the income from this source did not materially increase the earnings for the year. The ratio of operating cost to gross earnings, including the entire business for the year 1915, was 27 per cent and for the last month of the year 24 per cent. At the close of the year the number of customers on the company's books was 32,000, showing a gain of 3500 during the year. There was an increase in connected load during the year of approximately 61,000 kw. The present connected load amounts to approximately 200,000 kw. The total output of the system for the year was over 488,500,000 kw.-hr. and the highest peak-load demand was 89,000 kw. During the year a total of approximately $3,400,000 was expended in new construction work and plant betterments; the principal items of which were the Great Falls and Thompson Falls developments, and the transmission lines to serve the Chicago, Milwaukee & St. Paul Railway. The new dam and power house at the Great Falls of the Missouri River were completed and four of the six units installed. The plant has been in continuous operation since Aug. 11. Apparatus for the other two units of 10,000 kw. each has been ordered and will be installed this year, completing the plant to its full capacity of 60,000 kw. The estimated cost of this development was $3,853,510. The total amount expended to Dec. 31, 1915, was $3,593,634. The two additional units to complete the development are estimated to cost $375,000, making the total cost of the development, less salvage, about $3,950,000. The dam and power house at Thompson Falls on Clark's Fork of the Columbia River were completed and two of the six units of 5000 kw. each installed. During the last six months of the year power was delivered from this plant to the Montana-Idaho State line, where it was received by the mining companies in the Cœur d'Alene district for distribution to their various plants. Apparatus for two additional units has been ordered and will be installed during 1916. The remaining two units to complete the plant to its full capacity of 30,000 kw., it is stated, will be installed as the market warrants.

The estimated cost of this development was $2,870,386. The total amount expended to Dec. 31, 1915, was $2,341,355. The two units to be installed during 1916 are estimated to cost $309,300 and the two remaining units to be installed, as required, will cost about $300,000, making the total cost of the development, less salvage, approximately $2,900,000. The rapid increase of the business of the company, during the year 1915, has taken a considerable portion of the capacity of new plants brought into commission during the year and a further development of 40,000 kw. will be undertaken. The final completion of the Hebgen Dam, creating the seventh largest reservoir in the world, was accomplished during 1915. By means of this reservoir and other reservoirs located above the various generating plants, the company estimates that it has sufficient storage to increase the continuous flow of the Madison and Missouri Rivers 87 per cent over extreme low-water periods, thus insuring uninterrupted operations of the seven plants now developed on these rivers.

The installation of the electrical equipment of the Chicago, Milwaukee & St. Paul Railway has progressed satisfactorily during the past year and operations of trains over the sections between Deer Lodge and Three Forks, a distance of 112 miles, was begun on Dec. 2. The division between Three Forks and Harlowton is about completed, and operations over this division will probably begin about May 1, so that 226 miles between Harlowton and Deer Lodge will then be put in full electrical operation. Con-

siderable construction work has been done on the western division between Deer Lodge and Alberton, and it is expected that this division will be in operation in July next, and the entire distance from Harlowton, Mont., to Avery, Idaho, completed and in operation by the end of 1916.

"The outlook for the year 1916," President John D. Ryan states, "is good. The extension of the company's high-tension lines through new territories will result in new business from small towns and industries along these lines and will add to the increased earnings from growing business in old territories. Improvements in metallurgical process, both in copper and zinc, promise very substantial increases in demands for power, and the income from this source and the Chicago, Milwaukee & St. Paul Railway contract should result in a considerable increase in earnings for the present year." The combined earnings of the companies for 1913, 1914 and 1915 and for the properties for 1912 are as follows:

	1914	1915
Gross earnings	$3,778,285	$4,359,408
Operating expenses and taxes	1,139,046	1,191,904
Net earnings	$2,639,239	$3,167,504
Interest charges	1,063,614	1,189,162
Surplus over charges	$1,575,625	$1,978,342
Reserve for depreciation		300,000
Surplus over charges, 1915		$1,678,342

New Utility and Industrial Companies

The Hard Electric Company of Columbus, Ohio, has been incorporated with a capital stock of $10,000 by C. G. Hard, I. B. Martin and K. R. Hard.

The Topton Electric Company of Topton, Pa., has been incorporated by Laurence B. Myers, Edith H. Myers and John M. Groff. The company is capitalized at $5,000 and proposes to supply electricity in the borough of Topton.

The Northern Electric Service Company of Pennsylvania, Erie, Pa.—The company has increased its capital stock from $65,000 to $2,500,000. The company was recently formed by a merger of companies in Erie and adjoining counties.

The Economic Gas Water Heater Corporation of New York, N. Y., has been incorporated with a capital stock of $37,500 to deal in gas, water heaters, oil, gas and electrical machines. The incorporators are A. G. Halpin, A. Howell and N. W. Coan, 453 Grand Avenue, New York, N. Y.

The Yorkville Electrical Appliance Company of New York, N. Y., has been incorporated with a capital stock of $10,000 to deal in gas, electric fixtures, supplies, etc. The incorporators are R. Hoffman, H. P. Karlindecker and J. Hochman, 322 East Eighty-second Street, New York, N. Y.

The Wizard Electric & Manufacturing Company of Rochester, N. Y., has been incorporated with a capital stock of $10,000 to manufacture and deal in machinery, appliances, devices, etc. The incorporators are J. L. Whitley, C. H. Sampson and A. F. Bircher, 205 State Street, Rochester, N. Y.

The Hill Insulating & Manufacturing Corporation of New York, N. Y., has been chartered with a capital stock of $25,000 to manufacture motor vehicles, aeroplanes, boats, insulations, mica and allied forms. The incorporators are: C. G. Vogell, 2040 Seventh Avenue; A. Leach, 124 West 123d Street, and R. R. Hill, 302 Convent Avenue, New York, N. Y.

The Rockland Township Electric Company of Rockland, Pa., has been incorporated with a capital stock of $10,000 by Samuel D. Warriner of Philadelphia; Rollin H. Wilbur of St. Davids, and H. F. Baker of Germantown. The company proposes to supply electricity for lamps, heaters and motors in Rockland Township. The main office of the company is at 437 Chestnut Street, Philadelphia.

The Ruscombmanor Township Electric Company of Ruscombmanor, Pa., has been granted a charter with a capital stock of $10,000 for the purpose of supplying electricity for lamps, heaters and motors in the township of Ruscombmanor. The incorporators are: Samuel D. Warriner of Philadelphia; Rollin H. Wilbur of St. Davids and H. F. Baker of Germantown. The main office of the company is at 437 Chestnut Street, Philadelphia.

Trade Publications

Transformers.—Various types of transformers are illustrated in a folder issued by the Moloney Electric Company, St. Louis, Mo.

Water Meters.—The Neptune Meter Company, New York, has issued an illustrated booklet descriptive of various types of water meters.

Humidifiers.—Electrically-operated humidifiers are described and illustrated in bulletins sent out by the Normalair Company, Winston-Salem, N. C.

Service Entrance Fittings.—"Fused Service Entrance Condulets" is the title of Bulletin No. 1000F, recently issued by the Crouse-Hinds Company, Syracuse, N. Y.

Porcelain Insulators.—The Ohio Brass Company, Mansfield, Ohio, is sending out an illustrated folder which contains information on several types of porcelain insulators.

Signaling Device for Cranes.—The Nichols-Lintern Company, Cleveland, Ohio, has prepared an illustrated folder which contains information on its indicating signal for cranes.

Molded Insulating Material.—The Scranton (Pa.) Button Company has issued a sixty-two-page illustrated catalog which lists various devices made of molded insulating material.

Heat Resisting Molded Insulation.—The Hemming Manufacturing Company, Garfield, N. J., has just issued an attractively illustrated catalog on "Heat-Resisting Molded Insulation."

Cable Compound.—"Conduline—an Ideal Compound for Filling the Joints of Cables," is the title of an illustrated catalog just issued by the Mica Insulator Company, 68 Church Street, New York.

All-Gear Motor Drive.—Bulletin No. 1013, recently issued by the Reliance Electric & Engineering Company, Cleveland, Ohio, contains information on its all-gear motor drive for application to cone-pulley lathes.

Gasoline-Operated Trucks.—Light-service units and heavy-service units are the subject of Catalog A and Catalog B, respectively, issued by the Packard Motor Car Company, Detroit, Mich., on its chainless motor trucks.

Switchboards.—Type EB alternating-current switchboards equipped with hand-operated oil circuit breakers are the subject of Leaflet No. 3852, published by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Gasoline-Engine-Operated Lighting Plant.—The Main Electric Manufacturing Company, 500 Aiken Avenue, Pittsburgh, Pa., is sending out an illustrated folder which contains information on various applications of its small gasoline-engine-operated lighting outfit.

Price List of Lamp Cord and Flexible Cables.—The Safety Insulated Wire & Cable Company, 114 Liberty Street, New York, has just issued its No. 1233 price list covering the prices of national electric code standard lamp cord and flexible cables. It also contains information on the use and construction of the products.

Design of Turbines.—"Design of Intakes, Scroll Cases and Turbine Draft Tubes for Single Runner Turbines" is the title of a bulletin sent out by A. G. Hillberg, hydraulic engineer, Park Row Building, New York, which contains reprints of articles that appeared in the *Engineering Record* on Oct. 2, Oct. 9, Nov. 13 and Nov. 20, 1915.

Wooden Poles and Crossarms.—The Southern Exchange Company, 97 Warren Street, New York, has recently brought out an attractively illustrated pamphlet which contains considerable interesting information on Southern white-cedar and chestnut round poles, and long-leaf pine and yellow-pine octagonal and square poles and long-leaf pine crossarms.

Brass and Copper Products.—The U. T. Hungerford Brass & Copper Company, 80 Lafayette Street, New York, has just issued its latest catalog, which consists of more than 400 pages, is handsomely bound, and illustrates its complete line of brass and copper "Star Brand" products. The contents are classified in separate departments and the catalog contains a section with tables of weights and measures.

New England

HARDWICK, VT.—The Public Service Commission has granted the petition of the Eastern Vermont Utilities Corporation of Hardwick, recently incorporated by F. Monroe Dyer of New York, N. Y.; W. C. Clifford of Bethel; E. F. Clark of Groton; Albert A. Daniell of West Danville, and I. M. Frost of Rutland, to acquire land, riparian and water rights and other real estate and property in the towns of Barnet, Groton, Ryegate, Stannard, Walden, Peacham and Danville, and to acquire, develop and use waterpower, and to build and operate dams, storage basins, pipe-lines, power plants, hydraulic works and all necessary equipment to supply electricity for lamps, heaters and motors in said towns.

BOSTON, MASS.—Bids will be received by the directors of the Port of Boston, 40 Central Street, Boston, Mass., until April 20 for the purchase of surplus freight handling winches as follows: 10 double winches, numbered 1 to 10 inclusively; 8 single winches, numbered 11 to 18 inclusive. Each double winch is equipped with two drums and two winch heads and each single winch is equipped with one drum and two winch heads. For details see proposal columns.

SPRINGFIELD, MASS. — The United Electric Light Company of Springfield has applied to the Board of Harbor and Land Commissioners for permission to erect buildings on the Connecticut River, in Springfield.

TAUNTON, MASS.—The installation of a new boiler feed pump in the municipal electric-light plant is contemplated and the erection of a new 2200-volt, three-phase, two-phase transmission line, about 2 miles long, is under consideration. Leland D. Wood is manager.

WORCESTER, MASS.—Plans have been approved by the City Council for extensions to the ornamental street-lighting system. The cost is estimated at $8,000 for annual maintenance.

WOONSOCKET, R. I.—The Blackstone Valley Gas & Electric Company is planning to erect, in the near future, a local 13,000-volt, high-tension feeder and an addition to power station to provide space for new switching equipment, etc. A. F. Townsend is manager.

CROMWELL, CONN.—The town of Cromwell has granted the Connecticut Power Company of New London permission to construct a steam-driven power plant on the property known as the New England Brownstone quarry dock and to erect a transmission line on River Street. The company proposes to build a steam power plant in Cromwell to connect with the plant at Falls Village and the one at Middletown.

Middle Atlantic

BINGHAMTON, N. Y.—The Board of Supervisors has adopted the resolution appropriating $5,117 for the installation of an electric lighting plant at the county farm.

CHATHAM, N. Y.—Application has been made to the Public Service Commission by the Chatham Light, Heat & Power Company for permission to begin construction work and to exercise franchises for distribution systems in the towns of Austerlitz, Claverack, Hillsdale, Copake and Taghkanic, where the company has been granted franchises.

LOCKPORT, N. Y.—Bids will be received by the board of education, Lockport, until April 11 for completion of the enlargement, alteration and improvement of the Lockport Union School Building, including an auditorium and other work, separate bids to be submitted as follows: (1) Masonry; (2) carpentry; (3) plumbing; electrical wiring; (4) steam heating and ventilating. Plans and specifications are on file at the office of the board and at the office of William Neil Smith, architect, 101 Park Avenue, New York City.

NEW YORK, N. Y.—Bids will be received by the Fire Department, Room 1230, Municipal Building, New York, until April 6 for furnishing wire, copper, brass, steel, phosphor bronze wire rope and cable. Blank forms and further information may be obtained at the above office. Robert Adamson is commissioner of fire department.

NYACK, N. Y.—The Public Service Commission has approved of an issue of $200,000 in capital stock of the Rockland Light & Power Company of Nyack, part of the proceeds to pay for expenditures for improvements and extensions heretofore made and the remainder for new construction and extensions.

OLEAN, N. Y.—The Public Service Commission has granted the Olean Electric Light & Power Company permission to issue $159,000 ($126,000 in bonds and $33,000 in capital stock) the proceeds to be used to pay for new power station and equipment, including furnaces and boilers, steam engines, electric generators, etc., dams, canals, pipe-lines and distribution systems.

STAMFORD, N. Y.—The West Branch Light & Power Company is contemplating extending its transmission lines to Jefferson.

UTICA, N. Y.—The city of Utica will award a new contract for street-lighting in the fall. The present street-lighting system consists of 829 arc lamps, and 130 Mazda lamps maintained by aerial wires, and 175 luminous arc lamps maintained by underground wires. In the specifications covering the new contract the present system may be changed and investigations are now being made of modern systems in other cities. Harry R. Hayes is commissioner of public works.

EASTON, PA.—Charles Collmar, superintendent of streets and public improvements, in his report on the city street lighting, recommends the installation of a new municipal electric-light plant (which it is estimated would cost about $55,000), also that the city should at once purchase current to maintain 60 incandescent electric street lamps to take the place of the coal oil lamps now in use, and to light other dark streets.

ERIE, PA.—The Council has authorized B. E. Briggs, city engineer, to prepare data and draw up an ordinance for the construction of a 12-duct low-tension conduit on West Tenth Street from Peach to Cascade Street, to cost about $10,000.

SHIPPENSBURG, PA.— The Shippensburg Gas & Electric Company has entered into contract with the borough of Shippensburg for lighting the streets of the borough for a period of five years. The contract calls for a total of 146 incandescent lamps of 60, 100, 400 and 600 cp. All material has been purchased and it is expected to have the system in operation by April 15. C. W. Harman is superintendent.

SNOW SHOE, PA.—The property of the Snow Shoe Electric Company has been purchased by the Penn Public Service Company of Phillipsburg. This deal, it is expected, will result in the equipping of the numerous mines in this vicinity with electrically operated machinery and furnishing electricity for commercial and lighting purposes, between Phillipsburg and Snow Shoe.

WOODSTOWN, N. J.—The Woodstown Ice & Cold Storage Company will need a few electric fans. C. F. Moore is treasurer.

CUMBERLAND, MD.—The installation of a power plant at Lake Gordon to supply electricity for the street-lighting system in Cumberland is under consideration by the Chamber of Commerce. Joseph S. Schriver is water and light commissioner.

FREDERICK, MD.—The Board of Aldermen has decided to rebuild the municipal electric-lighting plant. The cost is estimated at $50,000, but as yet definite plans have not been decided upon.

PARKERSBURG, W. VA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D .C., until April 20 for remodeling an electric passenger elevator in the United States post office and court house, Parkersburg, W. Va. For details see proposal columns.

ORANGE, VA.—H. O. Lyne, it is reported, contemplates the construction of an electric-light plant and ice factory in Orange.

North Central

MACKINAC ISLAND, MICH.—The purchase of a recording wattmeter is contemplated by the Municipal Water, Light & Power Company. A. J. Doherty, Jr., is secretary and manager.

PONTIAC, MICH.—Plans are being considered by the City Commission for extensions to the ornamental lighting system on three streets.

BELPRE, OHIO.—The Kanawha Traction & Electric Company of Parkersburgh, W. Va., has submitted a proposal to the Town Council to supply electrical service in Belpre.

BUTLER, OHIO.—The city of Butler is contemplating discarding the flat rate for electrical service and installing meters. If the change is made about 175 meters will be required and will also need possibly 2500 ft. of No. 6 weather-proof wire. A. J. Grubb is clerk of board of trustees of public affairs.

CANTON, OHIO. — Arrangements have been made whereby all streets in the business section will be provided with an ornamental lighting system. The style of lamp has not yet been decided upon.

CINCINNATI, OHIO.—The City Council has approved the ordinance authorizing $6,000,000 in bonds for building the rapid transit loop, and for purchasing and condemning of the necessary land therefor.

CLEVELAND, OHIO.—Bids will be received at the office of commissioner of purchases and supplies, City Hall, Cleveland, until April 7 for furnishing double-braid, rubber-covered wire for the municipal electric-light plant. Specifications may be obtained at the office of the commissioner of light and heat division, 1443 East Third Street, Cleveland.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until April 7 for furnishing weather-proof copper wire for the municipal electric light department. Specifications may be obtained at the office of the commissioner of light and heat division, 1443 East Third Street, Cleveland.

CLVELAND, OHIO.—Extensive improvements and extensions will be made by the Cleveland Telephone Company this year, involving an expenditure of about $1,500,000. Of this $700,000 will be used for underground construction; $300,000 for the new Fairmount exchange, $100,000 for additions to the Eddy exchange and $75,000 for additions to the Mario Exchange. Allard Smith is general manager.

COLUMBUS, OHIO. — Service Director Borden has recommended to the City Council that Herman Gamper (former superintendent of the municipal plant) be employed to plan and supervise the extension to the lighting plant for commercial and residential lighting, for which the council has voted a bond issue of $265,000.

LONDON, OHIO.—The City Council is considering the question of whether to remodel the municipal electric-light plant or to acept a proposal submitted by the Ohio Electric Railway Company, Springfield, to sell energy to the city, erect a substation in London and install equipment necessary to standardize the municipal distribution system. The cost of remodeling the municipal plant is estimated at about $20,000.

MIDDLETOWN, OHIO.—The Ohio Gas & Electric Company has applied to the Public Utilities Commission for permission to issue $500,000 in bonds, $200,000 in debentures and $300,000 in capital stock, the proceeds to be used in acquiring the property of the Middletown (Ohio) Gas & Electric Company, the Franklin (Ohio) Electric Light Company, the Leetonia (Ohio) Electric Company and the New Lisbon (Ohio) Gas Company, and to make improvements and extensions to these properties.

OXFORD, OHIO.—The Board of Public Affairs is contemplating changing the system of the municipal electric plant from 133 cycles to 60 cycles, three-phase, some time in the late summer. Nothing definite has yet been decided upon. H. A. Demand is clerk of board.

REPUBLIC, OHIO.—The installation of an electric-lighting plan in Republic is under consideration by the city officials.

SPRINGFIELD, OHIO.—Bids will be received by the city of Springfield until April 13 for the installation of an ornamental (cluster lamps) lighting system.

STEUBENVILLE, OHIO.—The installation of a 2000-kw., General Electric three-phase, 60-cycle, 2200-volt turbo-generator and one 1000-kw. motor-generator set is under consideration by the La Belle Iron Works. James Farmington is superintendent of the electrical department.

ASHLAND, KY.—Bids will be received by the city clerk of Ashland until April 17 for one triple combination pumping engine of not less than 100 hp., pumping capacity of 750 gal.; one 40-gal. chemical tank, 200 ft. of chemical hose with a hose body capacity of 1200 ft. of 2½-in. hose, with ladders and complete equipment, electric lamps, electric self-starter, equipped with Dayton airless tires, maximum weight to approximate 10,000 lb.; one 75-hp. motor, city service truck, equipped with 55 ft. extension trussed ladder, equipped with electric lamps and self-starter, Dayton airless tires; 40-gal. chemical tank complete, maximum weight 8000 lb.

BARBOURVILLE, KY.—The power plant of the Barbourville Electric Light, Heat & Power Company was recently damaged by fire.

LEWISPORT, KY.—Jesse C. Emmick, owner of the local electric-light plant, contemplates the purchase of one boiler feed pump, three cylinder belt driven, one 5000-gal. pump, directly connected to a 220-volt,

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

direct-current motor, 10 ft. suction, 150 lb. pressure, on wheels to run on truck.

CORYDON, IND.—The Interstate Public Service Company contemplates improvements to its local plant soon. Frank R. Wright is manager.

FRANCESVILLE, IND.—The Central Indiana Water, Light, Heat & Power Company, which supplies electrical service in Francesville, Medaryville and Monon, expects to partly rebuild the distribution system in the residence portion of all three towns soon. All material has been purchased. E. A. Armstrong is superintendent.

GARRETT, IND.—The Water, Heat, Light and Power Department contemplates the installation of an additional boiler (perhaps 400 hp.), in the municipal power house this summer; also construction of a 150,000-gal. reservoir. W. W. Mountz is city clerk.

INDIANAPOLIS, IND.—Contracts have been awarded by the Merchants Heat & Light Company of Indianapolis for the installation of one 6250-kva. Westinghouse turbo-alternator with surface condenser, new radial smoke stack (brick, 300 ft. high and 15 ft. in diameter at the top)., one 56,000-gal. per hour feed-water heater, purifier and softening system, underfeed type of stokers amounting to 52 retorts, together with other plant changes necessary. A. W. Higgins is general manager.

MADISON, IND.—The Public Service Commission has granted the Madison Light & Railway Company permission to issue $13,000 in securities, the proceeds to be used for improvements to its plant.

PORTLAND, IND.—Bids will be received by the Commissioners of Jay County, Portland, Ind., until April 27, for the construction of a new court house. Plans and specifications may be obtained from John Bonifas, county auditor, Portland, or from McLaughlin & Hulsken, architects, Lima, Ohio.

WESTPORT, IND.—Bonds to the amount of $5,000 have been issued for the installation of a muicipal electric-light plant.

WINAMAC, IND. — Improvements are contemplated to the municipal electric-light plant, including the installation of a new boiler; also a new or second-hand engine and generator, exciter, etc., or turbine, poles and line materials. F. T. Morrisey is manager.

CARBONDALE, ILL.—Bids will be received at the office of the president of the Southern Illinois State Normal University at Carbondale until April 11 for construction of an auditorium building at Carbondale. Separate bids will be received at the same time for electric wiring, heating and plumbing. Plans and specifications may be obtained at the office of J. B. Dibelka, state architect, 130 North Fifth Avenue, Chicago.

HUME, ILL.—The installation of a municipal electric-lighting plant is under consideration by the Town Board.

MENDON, ILL.—Application has been made by the Mendon Electric Light & Power Company for a certificate of convenience and necessity to operate an electric-light and power plant at Mendon. James A. Thompson is president.

SPRINGFIELD, ILL.—Bids will be received at the office of the State Board of Live Stock Commissioners, Capitol Building, Springfield, until April 5, for construction of power house, including boilers and equipment, rendering and tankage. Also separate bids for addition to hog sheds, at laboratory grounds near Springfield. Separate bids will be received at the same time for electric wiring, heating and plumbing. Plans may be obtained at the office of J. B. Dibelka, state architect, 130 North Fifth Avenue, Chicago.

OGEMA, WIS.—The installation of an electric-lighting system in Ogema is reported to be under consideration.

SPOONER, WIS.—The city of Spooner has engaged Gardner S. Williams, 134 South La Salle Street, Chicago, Ill., as consulting engineer, in connection with the proposed hydroelectric power project.

HUTCHINSON, MINN.—Tentative plans have been filed with Secretary of State at St. Paul for extension of the Electric Short Line Railroad from Hutchinson through Thorp and Clare City to Dawson, a distance of 75 miles. John Westerdahl of Minneapolis is engineer.

BOONE, IOWA.—Bids will be received by the Board of Supervisors of Boone County, Boone, until April 14, for construction of court house and heating plant complete. Separate bids to be submitted on heating and plumbing, electric work, electric elevator and book lift. Plans and specifications are on file at the office of Norman T. Vorse, architect, S. & L. Building, Des Moines.

CARPENTER, IOWA.—Bids will be received by C. H. Thompson, secretary of school board of the consolidated school district of Carpenter until April 20, for construction of school building, including general construction, heating and ventilating, plumbing, electrical work, science and laboratory, gymnasium equipment. Plans and specifications are on file in the office of G. L. Lockhart, architect, Endicott Building, St. Paul, Minn., and in the office of the secretary of the school board, Carpenter.

DOW CITY, IOWA.—The city is considering the purchase of a 25-hp. oil-engine-driven emergency unit for the municipal electric-light plant; about 5000 ft. of No. 6, 4, and 2 weather-proof wire and triplex pump of about 200 gal. per minute capacity. H. G. McQueen is superintendent.

MOUNT PLEASANT, IOWA.—The city of Mount Pleasant expects to build a shop and coal house and install some coal-handling machinery in connection with the municipal electric-light plant. T. W. McMillan is superintendent.

MUSCATINE, IOWA.—The Muscatine Lighting Company is contemplating the installation of new power equipment, including steam turbine (rating not yet decided upon), 750-hp. water tube boiler. Plans are under consideration for increasing motor load. F. S. Dewey is general superintendent.

ORIENT, IOWA.—The town of Orient has voted to install a municipal electric-light system, including the erection of a transmission line to Creston, for which bonds to the amount of $10,000 have been voted.

SHELDON, IOWA.—Bids will be received by F. W. Bloxham, secretary of school board of the independent school district of Sheldon until April 14, for construction of a high and grade school, according to plans and specifications prepared by G. L. Lockhart, architect, Endicott Building, St. Paul, Minn. Separate bids to be submitted on general construction, plumbing, electrical work, science and laboratory equipment and gymnasium equipment.

WEBSTER CITY, IOWA.—The Fort Dodge, Des Moines & Southern Interurban Railway Company is reported to have purchased the Crooked Creek Railroad and will equip it for electrical operation and connect with the interurban railway of Fort Dodge, which, it is reported, is planning to extend its railway from Webster City to Ames.

ST. LOUIS, MO.—Plans have been completed for the enlargement of the building of the Union Electric Light & Power Company at the corner of Twelfth and Locust Streets, to cost about $250,000. The tower at the top will be crowned by a pyramid equipped with a novel lighting device.

ST. LOUIS, MO.—The Cupples Station Light, Heat & Power Company, which was recently granteed permission to place its wires in conduits outside of the underground district, is planning to erect a large power station on the river front. The company now has generating stations in the Railway Exchange Building, the Cupples station and at Wellston.

CAYUGA, N. D.—The installation of an electric-lighting plant in Cayuga is reported to be under consideration.

DOGDEN, N. D.—A petition is being circulated for the installation of an electric-light plant in Dogden.

EUREKA, S. D.—The Citizens Light & Power Company, recently organized, contemplates the installation of an electric-light and power plant in Eureka. C. Vorlander and J. A. Gardner are directors.

LAKE NORDEN, S. D.—Bids will be received by R. C. Bride, town clerk, Lake Norden, until April 18, for construction of electric-light and power plant and water-works system complete. Plans and specifications are on file at the office of the town clerk, Lake Norden and at the office of W. C. Buck, consulting engineers, Minneapolis, Minn., where plans and specifications may be obtained.

LEAD, S. D.—Preliminary steps have been taken by the City Commissioners for the installation of a municipal electric-lighting system.

SPRINGFIELD, S. D.—The Artesian Light Company is contemplating some improvements to its plant, but as yet nothing definite has been decided upon. J. L. Turner is president.

LINCOLN, NEB.—Bids will be received at the office of J. S. Dales, secretary board of regents of the University of Nebraska, Station A, Lincoln, until April 10, for construction of an agricultural engineering building on the University Farm campus, near Lincoln. Separate bids will be received for installation of heating and ventilating, plumbing and electric wiring. The cost of the building is estimated at $140,000. Specifications are on file in the office of the superintendent of construction, Administration Building, Lincoln.

OAK, NEB.—The Meyer Hydro Electric Power Company of Oak has applied to the State Railway Commission for permission to issue $100,000 in capital stock and $50,000 in bonds for the purpose of paying the cost of extending electric transmission lines.

OMAHA, NEB.—City Council has adopted the resolution providing that funds be set aside for ascertaining the cost of a municipal lighting plant for Omaha; also to engage an engineer to prepare plans and estimate of cost of same.

ORD, NEB.—Bids will be received by the city of Ord until April 14, for the construction of a municipal electric-lighting system. The cost of the system, including pole line, is estimated at $7,100. Bruce & Standevin, Bee Building, Omaha, are engineers. O. P. Cromwell is city clerk.

BUHLER, KAN.—Bonds to the amount of $5,000 have been voted for the installation of a municipal electric distribution system. Energy will be obtained from the Kansas Gas & Electric Company of Wichita, which will take charge of the installation of the system.

DIGHTON, KAN.—Plans are being prepared by W. B. Rollins & Company, Midland Building, Kansas City, Mo., for the installation of a municipal electric-light plant in Dighton. An election will soon be called to vote on a bond issue.

ELLINWOOD, KAN.—The City of Ellinwood has placed a contract with the Busch Sulzer Engine Company for a 120-hp. Diesel oil engine and an 80-kw. generator, to be installed within 60 days. R. H. Heagler is superintendent.

GARDEN CITY, KAN.—The power plant of the Garden City Telephone, Light & Manufacturing Company was recently damaged by fire. C. E. Marsh is manager.

MORGANVILLE, KAN.—The City Council has granted R. B. Fegall a franchise to construct and operate an electric-lighting plant in Morganville.

OSBORNE, KAN.—At an election to be held April 4 (change of date) the proposal to issue $14,000 in bonds for improvements to electric-light plant and water-works system will be submitted to the voters. E. T. Archer & Company, New England Building, Kansas City, Mo., are engineers.

TOPEKA, KAN.—Plans are being considered for the consolidation of the municipal electric-lighting plant and the water-works system. At an expense of $46,000 it is estimated that the city lighting plant on the east side of the city could be moved to the pumping station; the cost of the buildings is estimated at $8,150; new machinery, $17,000; for erection of transmission lines to transmit energy back to the city, $20,000, and moving expenses, $1,000.

VALLEY FALLS, KAN.—H. Swartz, owner of the local electric-light plant is changing the system from single-phase to three-phase. Poles have been erected; wire has not been purchased owing to the high price of copper.

WAKEFIELD, KAN.—Plans are being prepared by Burns & McDonnell, consulting engineers, Interstate Building, Kansas City, Mo., for the installation of a municipal electric-light plant and water-works system in Wakefield.

WETMORE, KAN.—The municipal electric light plant, consisting of a 35 kw. generator driven by a 35 hp. De La Vergne oil engine, is overloaded, and another generating unit and a larger engine must be added soon. L. L. Ruhlen is superintendent.

Southern States

UNIVERSITY, N. C.—The University of North Carolina has awarded the contract for designing and supervising construction of the new lighting and heating plant to the J. B. McCrary Company of Atlanta, Ga.

ORANGEBURG, S. C.—The City Council has decided not to award contracts for the construction of power station for the municipal electric-light and power system, but to build the plant under the supervision of the city engineer and city electrician. The building with machinery and equipment will cost about $50,000.

SAVANNAH, GA.—Bids will be received by the auditorium commission until April 16 for the construction of the municipal auditorium building for the city of Savannah. Separate bids to be submitted for electric wiring, plumbing, heating and ventilating. Plans and specifications may be obtained on application to Henrik Wallin, architect, 23 Abercorn Street, Savannah, upon deposit of $25 of which $20 will be refunded upon return of plans.

BROOKSVILLE, FLA.—The Brooksville Electric Light & Water Company has been granted a franchise to construct and operate an electric-light and power plant in Brooksville.

WEBSTER, FLA.—The town of Webster has granted Welborn, Zeller & Zeller of

Detroit, Mich. a franchise to construct and operate an electric-light plant; also to install a cold-storage plant and ice factory in connection with the electric plant .

ADAMS, TENN.—The South Kentucky Power Company of Pembrooke has been granted a franchise to install and operate an electric-lighting system in Adams.

BLUFF CITY, TENN.—The Bluff City Electric Light & Power Company contemplates the purchase of meters and lamps. R. W. Rush is secretary and manager.

DANDRIDGE, TENN.—The property of the Dandridge Power & Light Company has been sold by the receiver to Senator W. A. Lyle and Joseph Baker. The new owners, it is understood, will build a large dam on Felknor Creek, 3 miles east of the town, and drive the plant by water power.

LIVINGSTON, TENN.—The Livingston Light & Power Company, recently organized, has leased water rights and proposes to install a hydroelectric power plant, at a cost of about $10,000. S. O. Kennedy of Schenectady, N. Y., is president.

NEW TAZEWELL, TENN.—A company is being organized, with a capital stock of $25,000, to remove the electric-light and power plant from Tazewell to New Tazewell, to erect a flour mill with a daily capacity of 200 bbl. and to install a waterworks system in New Tazewell. J. W. Rose and Dr. M. B. Carr of Tazewell are interested in the project.

DECATUR, ALA.—The Alabama Power Company of Birmingham, it is reported, will increase the output of its steam power plant from 7500 hp. to 10,000 hp., at a cost of about $10,000.

BOONEVILLE, MISS.—The property of the Booneville Light & Water Company, it is reported, has been purchased by J. K. Kaye of Okolona. The new owner, it is understood, will rebuild the electric and water systems and install an ice factory.

GOODMAN, MISS.—The installation of a municipal electric-light plant in Goodman is under consideration.

FORT SMITH, ARK.—Improvements are contemplated by the Fort Smith Light & Power Company, involving an expenditure of about $50,000, and will include reconstruction of portions of Eleventh and Grand Avenues lines.

RUSH, ARK.—Plans are being considered by Ambrose Estes, promoter of the Rush Townsite, for the installation of an electric-light plant and waterworks system. The electric plant will be installed at the Edith Mill.

NEW ORLEANS, LA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until April 22 for furnishing one 60-kw., three-machine motor generator set and switchboard at the naval station, New Orleans, La. Specifications may be obtained at the above bureau or the industrial manager of the naval station named. F. R. Harris is chief of bureau.

CHICKASHA, OKLA.—The Chickasha Gas & Electric Company has been granted a 25-year franchise by the town of Verden, subject to approval of the voters. A three-phase, 6600-volt transmission line will be erected from Chickasha to Verden, a distance of 10 miles.

VERDEN, OKLA.—The board of trustees has granted the Chickasha (Okla.) Gas & Electric Company a franchise to supply electricity in Verden for a period of 25 years, subject to the approval of the voters.

AUSTIN, TEX.—The electric light department is considering making a special rate for electricity for heating and cooking purposes. E. C. Bartholomew is manager.

CORPUS CHRISTI, TEX.—The Corpus Christi Traction Company will begin work at once on the construction of an interurban electric railway from Corpus Christi to Ward Island, a distance of 8 miles. Contract for purchase of material, including engine and cars, has been placed with A. R. Ponder.

CUERO, TEX.—Arrangements have been made for the installation of an ornamental street-lighting system in Cuero.

LOCKHART, TEX.—Bids will be received by W. B. Swearingen, president, Citizens' Water, Light & Power Company of Lockhart, until April 18 for construction of water-works, electric-light plant and ice factory. Bids may be submitted separately on each item or upon the entire work as follows: One steel hemispherical bottom tank with tower; concrete and iron pump house; concrete and brick house for light and ice plant; one 30-ton ice machine, installed complete; one 100-kw. electric generating plant, installed complete; 400 tons class B cast-iron pipe, 4, 6 and 8 in., laid; 50 standard fire hydrants; 200 water meters, ⅝ in. and ¾ in., installed; 300 Michigan cedar poles, 30-35 ft., with fittings, set; 18 miles weatherproof wire, Nos. 4 to 10, strung; 250 electric service meters, placed. Plans and specifications may be seen at the office of the company in Lockhart, or at the office of Henry E. Elrod, consulting engineer, Southwestern Life Building, Dallas, Tex.

MOUNT PLEASANT, TEX.—The Texas Public Service Company of Mount Pleasant contemplates the installation of a triplex boiler feed pump and steel boiler settings. C. A. Bergen is manager.

Pacific States

PORT ANGELES, WASH.—Bids for a new contract to supply the city with electrical equipment, as it is needed, it is understood, will be advertised during April.

SEATLE, WASH.—Plans have been outlined by the Municipal Lighting Department for the construction of an addition to the Lake Union steam auxiliary plant in Seattle. The proposed generating unit will have a rating of 13,000 hp. The cost of extension, including equipment is estimated at $250,000. J. D. Ross, superintendent will have charge of the work.

SPOKANE, WASH.—Plans are reported to have been completed for the installation of an ornamental lighting system on Sprague Avenue, from Bernard Street to Madison Street, to cost about $48,000. Bids for the work will soon be asked for. Morton McCarthy is city engineer.

SPOKANE, WASH.—Arrangements are being made by the Mechants' Central Heating Company for the establishment of an electric plant, and contracts are being made for the delivery of electricity on or about Sept. 1. Electric ducts are being laid at the same time as the steam mains for a complete electrical distribution system. In addition to the generating equipment, consisting of Westinghouse turbo-generators, switchboard, etc., the service will be safeguarded by a large storage battery plant, which will supply emergency service. Harry A. Flood is president; E. Darrow, manager, and S. B. Clark superintendent of steam and electric distribution.

PORTER, ORE.—The auxiliary power plant of the Oregon Power Company of Eugene was recently damaged by fire, causing a loss of about $4,000. The plant, it is understood, will be rebuilt at once.

PORTLAND, ORE.—City Commissioner Daly has authorized City Attorney La Roche to prepare an ordinance providing for replacing the present overhead electric-light and telephone lines in the Central East Side with underground wires. It is proposed to remove all overhead wires, excepting trolley and arc-lamp wires, in this section.

SAN BERNADINO, CAL.—The Santa Fe Railroad, it is reported, is considering the installation of a power plant in its local yards, to supply electricity for its properties here. The cost of the proposed plant is estimated at $80,000.

BANCROFT, IDAHO.—Plans are being considered for the installation of a municipal electric-light plant, the source of power being located about 7 miles below Bancroft. A proposal to issue $30,000 in bonds to finance the project will soon be submitted to the voters.

JULIAETTA, IDAHO.—The local electric-light plant, owned by C. J. and J. C. Martins, has been purchased by Fred C. Holbrook of Culdesac. The new owner, it is understood, will make substantial extensions and improvements to the plant.

Canada

CALGARY, ALTA.—The City Council has approved an expenditure of $20,000 for additional cable for the Calgary Street Railway system.

EMERSON, MAN.—The installation of an electric-light plant in Emerson is reported to be under consideration.

COLLINGWOOD, ONT.—Tenders will be received by Hugh Currie, chairman, Collingwood Water and Light Commission, until April 11, for pumping machinery, consisting of two motor-driven units, having a capacity of 1000 Imperial gal. each; also for pump well connections. Plans and specifications may be seen at the office of Chipmans & Power, engineers, Mail Building, Toronto, or at the office of the commission, Collingwood.

RENFREW, ONT.—The Renfrew Power Company is contemplating the purchase of transformers, wire, meters, lamps, etc. Robert Handley is secretary.

SARNIA, ONT.—Plans are being considered by the Hydro Commission of Sarnia for installing a lighting system for the water front, including the frontage of the Grand Trunk Railway system and the Northern Navigation Company. Ornamental lamps of 1000 cp. are planned for the business section and hundreds of nitrogen-filled lamps will be used on the side streets. Railway and boat companies will be asked to improve their river frontage.

SAULT STE. MARIE, ONT.—Negotiations have been closed whereby the municipal electric-light plant at the Sault, the street railway system and the international ferry running between Sault Ste. Marie, Ont., and Sault St. Marie, Mich., has been taken over by the Algoma Steel Corporation and the Great Lakes Power Company, recently incorporated. Plans have been prepared by the Great Lakes Company for improvement to the local plant, to cost about $3,000,000. It is proposed to develop about 30,000 hp., nearly all of which has been contracted for by the Algoma Steel Corporation.

ST. THOMAS, ONT.—Contracts have been awarded for the construction of a new substation for the municipal lighting system, which will be equipped with two 750-kva., three-phase transformers in addition to present equipment. The station will have a total capacity of 2500 kva. E. H. Caugheil is manager.

TILSONBURG, ONT.—The Tilsonburg Water and Light Commission is contemplating an extension of its electrical system from Tilsonburg to Brownsville, Springfield, Mount Elgin and rural districts in this district. The Town Council is considering the advisability of installing a motor-driven centrifugal fire pump. John E. Teckoe is superintendent .

TORONTO, ONT.—The Provincial Hydro Commission, it is reported, has approved the application of the Civil Hydro Commission for permission to issue debentures to the amount of $1,375,000 for extensions to the local system.

TORONTO, ONT.—Tenders will be received by T. L. Church, Mayor, chairman of board of control, City Hall, Toronto, until April 11, for furnishing electrically operated driving gear for operating 36-in. gate valves at main pumping station. Specifications may be obtained at the Water Works Department, Room 12, City Hall, Toronto.

Mexico

MAZATLAN, SINALOA, MEX. — The Empressa de Corriente Electrica of Mazatlan contemplates the installation of a storage battery plant (110 volts, 100 amp. six hour), converter, etc. Arthur de Cima is general manager.

Miscellaneous

CORDOVA, ALASKA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until April 22, for the construction of two 300-ft. steel towers at the radio station, near Cordova. Plans and specifications may be obtained upon application to the bureau.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until April 6 for the purchase of copper cable offered for sale by the Panama Canal, which is no longer needed. Blanks and general information relating to this circular (No. 1024) may be obtained at the above office and the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal. Major Earl I. Brown is purchasing officer.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until April 13 for furnishing steel angles, brass tubing, copper sheathing, laundry water heater, ejectors, etc. Blanks and general information relating to this circular (No. 1026) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal. Major Earl I. Brown is purchasing officer.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until April 8 for furnishing laundry washers, track frogs, switches, switch-stands, steel plates and billets, sheet copper, copper tubing, cable clips, grommets, grease cups, clocks, marine lamps, calcimine brushes, watt-hour meters, panel boards, marine fixtures, electrical fittings, etc. Blanks and general information relating to this circular (No. 1023) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal. Major Earl I. Brown is purchasing officer.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, Arthur Kneisel, 29 South LaSalle St., Chicago, Ill.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Permanent secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Semi-annual meeting, Washington, D. C., April 27-29.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, Edwin A. Scott, 29 West 39th St., New York.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary-treasurer, Roy B. Fowles, Pine Bluff, Ark. Convention, June 6-8.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General Secretary, C. E. Dustin, 62 Cedar St., New York.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, George C. Holberton, San Francisco, Cal.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, W. O. Oschman, Oliver Iron & Steel Co., Pittsburgh, Pa. Annual convention, Chicago, Sept. 18-22.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 112 West Adams St., Chicago.

CALIFORNIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, James Redpath, 505 Rialto Building, San Francisco, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Secretary-treasurer, Alan Sullivan, Excelsior Life Building, Toronto, Can.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

COMMERCIAL SECTION, N. E. L. A. Secretary, C. A. Littlefield, 130 East 15th St., New York.

EASTERN NEW YORK SECTION, N. E. L. A. Secretary, J. E. Kearns, General Electric Company, Schenectady, N. Y.

ELECTRICAL CONTRACTORS' ASSOCIATION OF CONNECTICUT. Secretary, George M. Chapman, Waterbury, Conn.

ELECTRICAL CONTRACTORS' ASSOCIATION OF MASSACHUSETTS. Secretary, H. D. Temple, 30 Foster St., Worcester, Mass.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF THE STATE OF PENNSYLVANIA. Secretary, M. G. Sellers, 1518 Sansom St., Philadelphia.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert Petermann, 626 Lloyd St., Milwaukee, Wis.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, H. B. Crouse, Crouse-Hinds Co., Syracuse, N. Y.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Next meeting, Hot Springs, Va., June 7, 8 and 9.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, 34 Ellis St., San Francisco, Cal.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Affiliated with the N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla.

GEORGIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. A. Wier, Athens, Ga.

ILLINOIS ELECTRIC ASSOCIATION. Secretary, H. E. Chubbock, Peoria, Ill.

ILLINOIS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. L. Blumenthal, 179 West Washington St., Chicago, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, C. A. Littlefield, 15th St. and Irving Place, New York. Annual convention, Philadelphia, Sept. 18, 19 and 20.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind. Annual meeting, April 19, 1916.

INDIANA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, George Skillman. Indianapolis, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF OPERATING ENGINEERS. Secretary, L. Houmiller, 29 West 39th St., New York.

INSTITUTE OF RADIO ENGINEERS. Secretary, David Sarnoff, 111 Broadway, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA SECTION, N. E. L. A. Secretary, W. H. Thomson, Jr., Des Moines, Iowa. Annual meeting, Dubuque, Iowa, May 10-12.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Iowa.

JOVIAN ORDER. Jupiter (president), Thomas A. Wynne, Indianapolis, Ind.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. A. Mercer, 108 West Eighth Ave., Topeka, Kan.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Temporary secretary, E. A. Wright, Manhattan, Kan.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. J. Ziegler, 227 Bourbon St., New Orleans.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Waterville, Maine.

MICHIGAN SECTION, N. E. L. A. Secretary. Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

MINNESOTA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, G. M. Jones, 14 Seventh St., N., Minneapolis, Minn.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary-treasurer, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the N. E. L. A. Secretary-treasurer, R. H. Smith, Jackson, Miss.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis. Annual convention on steamer Quincy, May 11-13.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Concord, Mass.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual convention, New York, May 16-19.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York. Annual convention, Chicago, May 22-27.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y. Annual meeting, New York, July 18-22.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee. Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, B. E. Egan, Room 201, Union Pacific Building, Omaha, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 60 State St., Boston, Mass.

NEW ENGLAND SECTION, ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, L. L. Edgar, 39 Boylston St., Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, E. A. Thiele, Roswell, N. M.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York.

NORTHWEST SECTION, N. E. L. A. Secretary, E. H. LaTourneau, 602 Electric Building, Portland, Ore. Annual convention, Seattle, Wash., September.

NORTHERN WHITE CEDAR ASSOCIATION. Secretary, R. N. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual convention, Cedar Point, July 18-21.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus. Annual meeting, Cleveland, June 15 and 16.

OREGON ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary-treasurer, J. W. Oberender, 502 Dekum Building, Portland, Ore.

PENNSYLVANIA ELECTRIC ASSOCIATION (State Section N. E. L. A.). Secretary-treasurer, H. N. Müller, 435 Sixth Ave., Pittsburgh, Pa. Annual convention, Eagles Mere, Sept. 5-8.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston, W. Va.

RAILWAY SIGNAL ASSOCIATION. Secretary-treasurer, C. E. Rosenberg, Times Building, Bethlehem, Pa.

ROCKY MOUNTAIN ASSOCIATION OF MUNICIPAL ELECTRICIANS. President, Lawrence Stone, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOUTH DAKOTA ELECTRIC LIGHT ASSOCIATION. Secretary, A. H. Savage, Dakota Light & Power Co., Flandreau, S. D.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, George H. Wygant, Tampa, Fla.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Texas. Annual meeting, Galveston, May 17-20.

TEXAS STATE ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, Chas. W. Graham, Dallas, Tex.

TRI-STATE WATER & LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

UNITED STATES INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, W. S. Vivian, 19 South LaSalle St., Chicago, Ill.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, C. H. West, Rutland, Vt.

VIRGINIA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. M. Andrews, Richmond.

WATER POWER DEVELOPMENT ASSOCIATION. Secretary, Marcus A. Beeman, Munsey Bldg., Washington, D. C.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 Jackson Bldg., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis.

1,175,931. Coupling for Power Wires; R. D. Coombs, Brooklyn, N. Y. App. filed April 19, 1913. For securing high-tension cables to insulators.

1,175,954. Process of Making Storage Battery Electrodes; H. C. Hubbell, Newark, N. J. App. filed June 5, 1911. Nickel electrode oxidized on charge.

1,175,977. Cooling System for Electric Motors; J. W. Nolan, Pawtucket, R. I. App. filed Feb. 2, 1914. Air-cooling casing about motor.

1,176,018. Furnace; T. F. Bailey and F. T. Cope, Alliance, Ohio. App. filed Dec. 11, 1914. Constructed to reflect the heat generated in a resistance material.

1,176,034. Electric Cut-out; J. F. Conrad, Nanty Glo, Pa. App. filed Dec. 13, 1913. For mine trolley systems.

1,176,035. Electric System; J. L. Creveling, New York, N. Y. App. filed March 16, 1910. Axle-driven battery-charging system.

1,176,036. Electric Brakes for Automobiles; D. M. Dailey, Gary, Ind. App. filed June 23, 1915. Plurality of magnetics produce gradual appication of brakes.

1,176,045. Telephone Prepay Box; F. L. Fisher, Decatur, Ill. App. filed Aug. 20, 1915. Adapted to party or individual service on automatic or manual systems.

1,176,102. Means for Operating Switch Mechanism; R. A. Schoenberg, New York, N. Y. App. filed May 22, 1915. Socket switch operated by pushing and pulling on the lamp in the socket.

1,17,105. Separator; H. R. Swartley, Jr., Manhassett, N. Y. App. filed Sept. 15, 1915. For electrolytic cells used in the production of oxygen and hydrogen.

1,176,119. Railway Signal and Stopping Mechanism; F. C. Williams, Philadelphia, Pa. App. filed Dec. 14, 1910. Train automatically controlled by conditions of track signals.

1,176,137. Insulator Bracket; C. G. Ette, St. Louis, Mo. App. filed March 1, 1915. Made of cast metal.

1,176,147. Telegraphy; E. Keen, New York, N. Y. App. filed Nov. 6, 1908. Art of reproducing pictures at a distance (sixty-seven claims).

1,176,148. Telegraphy; E. Keen, New York, N. Y. App. filed March 8, 1910. Art of reproducing pictures a distance (sixty-seven claims).

1,176,149. Telegraphy; E. Keen, New York, N. Y. App. filed Oct. 14, 1911. Art of reproducing pictures at a distance (Sixty-seven claims).

1,176,178. Switching Device; W. F. Straub, Chicago, Ill. App. filed Dec. 9, 1912. For primary and secondary clock systems.

1,176,202. Circuit-Controlling Apparatus; H. W. Cheney, Milwaukee, Wis. App. filed March 27, 1909. Large-capacity element motor-operated remote control.

1,176,203. Lamp-Socket Support; G. W. Comer, Chicago, Ill. App. filed April 30, 1914. Capable of great variety of adjustments.

1,176,217. Electric Cooking-Range; A. H. Happe and W. J. Keep, Detroit, Mich. App. filed June 30, 1915. Relatively flat and compact with plurality of grids.

1,176,231. Resistance Box; F. W. Magin, Milwaukee, Wis. App. filed Aug. 14, 1914. Screen prevents escape of flame and molten parts.

1,176,260. Automatic Telephone System; C. S. Winston, Chicago, Ill. App. filed Feb. 24, 1911. Two-wire type.

1,176,259. Telephone-Repeater; A. H. Blessing, Fennimore, Wis. App. filed April 3, 1913. Common battery, two wire.

1,176,282. Wireless Signaling; R. A. Fessenden, Washington, D. C. App. filed Dec. 14, 1904. A. C. at receiving station of same frequency as group frequency of the signaling impulses.

1,176,288. Insulating Splice-Cover; J. B. Hamilton, Hoboken, N. J. App. filed March 6, 1914. Insulating cap applied over spliced-wire ends.

1,176,316. High and Low Pressure Continuous Current System; W. J. Rickets, Brockley, London, England. App. filed April 6, 1914. Supplies lower pressure D. C. from higher pressure mains.

1,176,320. Transmitting Apparatus for Wireless Telegraphy; L. Rouzet, Levallois-Perret, France. App. filed Sept. 11, 1911. Condenser connected with charging circuit and with oscillating discharge circuit.

1,176,333. Insulator-Pin; J. Baker, Battle Creek, Iowa. App. filed June 28, 1913. Sheet metal constructed to embrace cross arm.

Record of Electrical Patents

Notes on United States Patents issued March 21, 1916, prepared by Mitchell & Allyn, 41 Park Row, New York.

1,176,373. System of Supplying Electrical Energy on Special Tariffs; H. Landis, Zug, Switzerland. App. filed Jan. 23, 1912. Suitable for installation in premises where consumption is small.

1,176,374. Electric Lighted Level; E. G. Laplante, Marlboro, Mass. App. filed Oct. 6, 1915. Silgle-bulb illuminator, both levels.

1,176,377. Gear Shift for an Electric Motor; B. M. Leece, Cleveland, Ohio. App. filed June 2, 1913. Particularly for starting gas engines.

1,176,396. Centrifugally - Regulated Power-Transmission System; W. Morrison, Chicago, Ill. App. filed June 8, 1915. Automatic cut-out for automobile battery charging.

1,176,397. Trolley Retriever; L. V. Moulton, Grand Rapids, Mich. App. filed Nov. 7, 1914. Adapted to trolley poles having different lengths of lifting springs.

1,176,413. Terminal for Electric Wires; J. M. White, Philadelphia, a. App. filed Oct. 11, 1915. Sheet metal and easily applied.

1,176,400. Trolley-Wheel Guard; T. J. Nugent, Baltimore, Md. App. filed Oct. 19, 1915. Applicable without change to trolleys in use.

1,176,420. Electric Soldering-Machine; A. A. Bacon, Geneva, N. Y. App. filed Nov. 13, 1911. For securing the small parts of eye-glasses and the like.

1,176,421. Magnetic Device; C. E. Beach, Binghamton, N. Y. App. filed May 29, 1911. Direct polarized for electro-mechanical signaling.

1,176,422. Magneto Device; C. E. Beach, Binghamton, N. Y. App. filed June 11, 1915. Polarized, has greater armature stability.

1,176,440. Contact Device for Electric Traction System; H. S. Farquar, Wayne, Pa. App. filed Jan. 2, 1915. Contact pressure can be intensified by magnetic attraction.

1,176,460. Fire Detector Apparatus; C. H. Kayser and W. H. Hampton, West Orange, N. J., and New York, N. Y. App. filed Sept. 25, 1912. Uninfluenced by normal temperature fluctuations.

1,176,467 and 1,176,468. Flash-Light Battery Container; H. M. Koretzky, New York, N. Y. App. filed Aug. 12 and Aug. 14, 1915. Made from a single flat blank.

1,176,470. Sender; J. A. Kroop, Newark, N. J. App. filed Nov 6, 1914. Automatic or semi-automatic telephones.

1,176,474. Magnetizer; C. C. McDonald, Chenoa, Ill. App. filed Nov. 18, 1914. For remagnetizing permanent magnets.

1,176,476. Ignition Dynamo; C. T. Mason, Sumter, S. C. App, filed July 28, 1913. Dual ignition system with simplified wiring.

1,176,499. Fire-Alarm Box; E. Tokarski, Pittsburgh, Pa. App. filed Aug. 27, 1915. Hand-cuff holds person sending in alarms.

1,176,502. Igniter Mechanism for Internal Combustion Engines; H. R. Van Deventer, Sumter, S. C. App. filed Dec. 24, 1914. Self contained ignition unit.

1,176,515. Electrical Socket and Plug; C. H. Bissell and E. G. Smith, Syracuse, N. Y. App. filed July 29, 1911. Rectangular construction.

1,176,521. Burglar Alarm; J. Chankin, New York, N. Y. App. filed Aug. 27, 1915. Readily applied to door or window.

1,176,522. Telephone System and Individual Transmitter Therefore; C. L. Chisholm, Marsville, New Brunswick, Canada. App. filed March 21, 1910. Watch-case transmitter adapted for application to telephone standard.

1,176,539. Indicating Device for Automobiles; A. E. Gaugh and J. Cawby, Lexington, Ky. App. filed Nov. 5, 1914. Solenoid operated.

1,176,540. Electrolytic Cell; A. E. Gibbs, Wyandotte, Mich. App. filed March 24, 1913. Cathode composed of strong castings.

1,176,541. Process of Electrolysis; A. E. Gibbs, Philadelphia, Pa. App. filed Oct. 25, 1913. Constant flow of liquid across the electrolytic field.

1,176,542. Motor Controller; M. M. Goldstein, Milwaukee, Wis. App. filed Feb. 16, 1915. For multiple unit printing presses.

1,176,544. Protective Device; G. F. Gray, Schenectady, N. Y. App. filed March 10, 1913. Low voltage, for telephone, etc.

1,176,551. Apparatus for Decomposing Alkali Chloride Solutions; K. Heinemann, Pirna, Germany. App. filed March 27, 1914. Flowing mercury cathode with impediments to flow.

1,176,554. Electrical Connection; S. Herzig, New York, N. Y. App. filed Sept. 7, 1915. Pivot connection for telephone wires, etc.

1,176,559. Method of an Apparatus for Electrical Measurement; C. A. Hoxie, Schenectady, N. Y. App. filed Nov. 8, 1912. Particularly for measuring capacity and inductance.

1,176,569. Contactor with Antiwelding Device; M. K. Kjolseth, Schenectady, N. Y. App. filed March 31, 1914. Improved means for preventing contacts sticking.

1,176,577. Sound Transmitter; B. F. Lee, Schoolfield, Va. App. filed Feb. 9, 1915. Improved sound transmission.

1,176,590. Protected Insulator; J. H. Mock, Jetmore, Kan. App. filed Feb. 8, 1915. Housed in casing.

1,176,602. Metallic Filament Electric Incandescent Lamp; H. C. G. Remané, Berlin, Germany. App. filed Oct. 3, 1912. illuminating body interlaced with the rigid holders.

1,176,614. Welding Pressure Contact; A. M. Stanley, Lynn, Mass. App. filed Jan. 23, 1915. Tungsten or molybdenum, for welding copper sheets, etc.

1,176,616. Switch Operating Mechanism; H. M. Stevens, Schenectady, N. Y. App. filed March 18, 1913. Very sensitive releasing mechanism.

1,176,618. Insulator; W. E. Swearingen, Montgomery City, Mo. App. filed April 21, 1915. Automatic lock prevents undue longitudinal movement of wire in a protected slot.

1,176,622. Electrical Attachment Plug; W. C. Tregoning, Cleveland, Ohio. App. filed Dec. 21, 1914. Binding screws accessible at front end of plug.

1,176,623. Spark Gap Adjuster; L. Tronchon, Paris, France. App. filed April 9, 1913. Frame made up of members forming a deformable parallelogram.

1,176,625. Electric Brake; J. J. Tyson, Montgomery, Ala. App. filed March 9, 1915. For railway trains.

1,176,629. Tree Insulator and Wire Supporter; W. H. Wallace, Roscommon, Mich. App. filed Sept. 10, 1915. Insulating tube with surrounding attacher.

1,176,630. Vapor Electric Device; E. Weintraub, Lynn, Mass. App. filed March 27, 1914. Platinum anode and halogen compound.

1,176,632. Electrical Machine; F. Werner, Hamilton, Ontario, Canada. App. filed April 17, 1915. Compound collector and short circuiting device for induction holder.

1,176,634. Time Element; A. Aichele, Baden, Switzerland. App. filed May 12, 1914. For overload contacts, and the like.

1,176,635. Push-Button Switch; J. M. S. Anderson, Bridgeport, Conn. App. filed July 20, 1915. Improved mounting of the metal supporting frame.

1,176,659. Attachment-Plug; F. C. De Reamer, Schenectady, N. Y. App. filed Aug. 2, 1911. Swivel construction.

1,176,660. Electric Switch; F. C. De Reamer, Schenectady, N. Y. App. filed June 17, 1914. Particularly suitable for mounting on the handle of a suction cleaner.

1,176,664. Vapor Electric Device; P. K. Devers, Lynn, Mass. App. filed March 27, 1914. Associates with the mercury a halogen compound leaving the desired spectrum.

1,176,668. System of Ship Propulsion; W. L. R. Emmet, Schenectady, N. Y. App. filed Aug. 21, 1911. Electrical propulsion with special provision for cooling the resistances.

1,176,698. Electric-Plant-Control Device; A. H. Brandon, Toledo, Ohio. App. filed Oct. 21, 1912. Particularly relates to storage battery plants.

1,176,715. Telephone-Exchange System; T. G. Martin, Chicago, Ill. App. filed Aug. 17, 1906. Automatic or semi-automatic in which system is divided into districts.